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Three gangs of brick setters worked with three carriers to each setter on job south of Springfield, Illinois

Trend in Resurfacing

Pavements With Brick

By GEO. F. SCHLESINGER

Chief Engineer and Managing Director, National Paving Brick Association

WHEN a brick resurfacing project is being considered, the question always arises as to whether the old concrete slab will be satisfactory as a base for the new surface. It is essential that the existing concrete be resurfaced before it has deteriorated to a point where its future adequacy as a base may be questioned. In considering the condition of the concrete pavement to be resurfaced most engineers consider that its past existence endows it with certain advantages as compared with a new base. The combined action of traffic and weather over a period of years has tended to bring about stabilized conditions. Failures due to slab weakness or subgrade conditions have usually been corrected. For these reasons it is contended that there is less uncertainty regarding future eventualities than with a new base course on a new subgrade. Additional curb and widening is a usual accompaniment of brick resurfacing. This affords opportunity in the design for structural reinforcing of the old slab if this is considered necessary. There will be further reference to this in the discussion of design. Of course, the replacement with new concrete of completely disintegrated sections is a part of the reconstruction procedure.

It is believed that addition to the structural strength of the old concrete is not the primary function of resurfacing. In most cases structural weakness has not been the principal cause of the unsatisfactory condition of the existing slab. Subgrade and concrete volume changes, frost action and the general effect of time and the elements may be mentioned as more potent factors. However, the addition of 3½ or 4 inches of brick and cushion to the thickness of the paving structure does serve to decrease the load concentration on the subgrade. The principal reasons why the addition of wearing courses increases the service value of old concrete slabs are believed to be:

(1) Progressive breakage of the concrete is arrested.

(2) Protection is given against temperature and climatic extremes. The new surface and widening completely envelops and waterproofs the top and sides of the old concrete.

(3) The new smooth surface decreases traffic impact and checks further vertical displacement of the sections of broken slab.

(4) The direct abrasive wear of traffic is transferred from the concrete to the wearing surface. This is of especial consequence in the case of chained wheel traffic in winter.

Design Features.—The design of a pavement structure for the resurfacing of an existing concrete slab with brick has been productive of variations in details. It is the almost universal practice to accomplish widening at the time the pavement is resurfaced. If the concrete is 18 feet in width, it is customary to use a 12-in. curb raised above the existing slab, on each side, providing a header for the new brick surface and making the total new pavement width twenty feet (Fig. 1). If the concrete width is less than 18 feet the practice varies. The total width of twenty feet can be attained entirely in the new concrete curb (Fig. 5); or the old slab can be extended with new concrete with an integral curb of standard dimensions (Figs. 2-3-4-6). The latter method is in greater use and has in its favor a more pleasing appearance because of a uniform width of brick surface and concrete curb; a greater effective travelable surface as vehicles are prone to keep off the curb.

In some cases a mechanical connection has been provided between the old slab and the new concrete widening with the object of preventing possible vertical displacement at the junction line. In one method the new concrete has been extended under the old slab a depth of 6 inches and a width of from 6 to 12 inches, with reinforcing (Fig. 6) or plain (Figs. 3-5). The Illinois section of 1931 (Fig. 5) also provided for a projection over the old slab, but this was changed in 1932 when the uniform 12 inch curb was adopted (Fig. 3). The 1932 design also economizes in concrete by using a beveled or sloping curb bottom. In the Illinois designs a continuous ⅞ inch round lubricated edge bar is placed in the new concrete curb. In one design used in Ohio ⅝-in. by 18-in. round deformed anchor bars were inserted and grouted in the old slab (Fig. 2). This practice was later discontinued because of doubtful value and difficulty in construction. There is a difference of opinion as to whether a mechanical connection is worth the additional cost. Arguments agains this practice are that the old compacted subgrade is disturbed and proper construction is difficult. Test cores taken in the Illinois work showed in general that the concrete was being forced under the slab satisfactorily although it was necessary to permit a slump of 4 to 6 inches.

Fig. 1—Indiana Highway Commission (Standard)

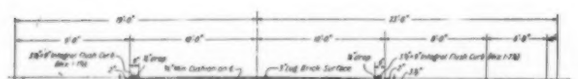


Fig. 2—Ohio Highway Department (Route 73)

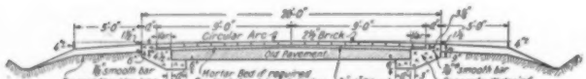


Fig. 3— Illinois Division of Highways (1932 Standard)

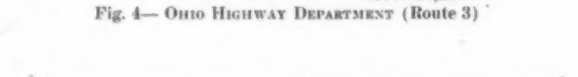


Fig. 4— Ohio Highway Department (Route 3)

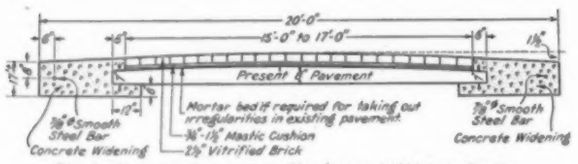

20'-0"
15'-0" to 17'-0"
Present 8" Pavement
Mortar bed if required for taking out irregularities in existing pavement
3½"-1½" Mastic Cushion
2½" Vitrified Brick
⅞"ø Smooth Steel Bar Concrete Widening
⅞"ø Smooth Steel Bar Concrete Widening

Fig. 5—Illinois Division of Highways (1931 Standard)

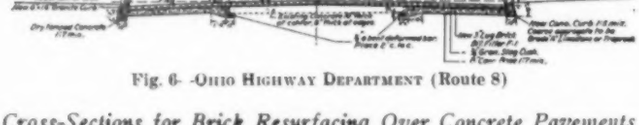


Fig. 6- Ohio Highway Department (Route 8)

Cross-Sections for Brick Resurfacing Over Concrete Pavements Which Are Typical of the Latest Practice

In the Indiana standard section (Fig. 1) and in a majority of the projects constructed in Ohio (Fig. 4) no attempt has been made to join the new base or curb with the old slab. Ohio, which formerly made the curb 12 inches wide, has now adopted a 9 inch width as standard (Fig. 4). For reasons already given this increases the surface that will normally be used by traffic.

There are also differences in the material specifications and construction methods which will be discussed.

Construction Methods—The proper construction of the brick course itself presents no problems that are peculiar to resurfacing. In line with general practice lugless wire cut brick (vertical fiber) of 2½-in. depth has been used west of Ohio and 3 inch lug brick in Ohio. The type of lug brick, introduced about two years ago, that is meeting with almost universal favor is the vertical fiber lug. This differs from the old wire cut lug brick in having the wire cut side instead of the die side in the pavement surface. The recently developed "surface removal" method of filler application insures a clean brick surface immediately after completion.

There is a divergence of practice in the method of correcting irregularities in the old slab and in the type of bed or cushion course. The method used in the former is to some extent dependent upon the type of material in the cushion. A plain sand cushion should not vary in the thickness and the base should be brought to a true cross section. For granulated slag—which has cementing properties—sand cement and bituminous mastic bed a variation of ¾-in. to 1½-in. is the usual tolerance permitted. For correcting large irregularities, a cement sand mortar—1:3 proportions—is the material commonly specified. Bituminous concrete has also been used.

The function of mortar or bituminous materials used in correcting irregularities in the old slab is as a filler for shaping up and not to add structural strength. Being confined under the brick course and cushion proper and between the curbs there is little opportunity for displacement even if cracking occurs.

The development and extensive use of the bituminous mastic cushion has been coincident with the brick resurfacing program in Illinois. In sections of the country where granulated blast furnace slag is not economically available mastic cushion is recommended for all brick paving construction. It is stable but resilient, will not sift down into small cracks, has water proofing qualities and would seem to be especially applicable to brick resurfacing construction.

In the resurfacing constructed in Illinois in 1931 expansion joints, extending the full depth of the pavement, were placed. They were 4 inches in width at about 1,000 foot intervals and filled with asphalt. It was

also the practice to locate them at points where "blow-ups" had occurred in the old slab. In the projects constructed in 1932 this feature of design has been eliminated. This conforms to general practice for brick surface construction as transverse expansion joints have not been found necessary with a bituminous filler.

It is the general practice to require that all cracks in the concrete in place be thoroughly cleaned and filled with bituminous material. The excavation for the widening curb would appear to present difficulties especially for the beveled section used in Illinois (Fig. 3). Their specifications require that "all loose earth shall be removed and any excavation outside the dimensions shown on the detailed cross-section shall be filled with concrete at the contractor's expense." However, contractors have been very ingenious in devising equipment to cut the sections without hand labor. It is accomplished by several trips of a tractor drawn excavator which has changeable cutting blades.

Resurfacing of Concrete Bases

In the form that this type of reconstruction usually takes it is really a replacement operation. That is, the condition of the original surfacing material having become unsatisfactory, it has been removed and replaced with a new surface course after the old concrete base has been properly rehabilitated. In the case of brick pavements, in some instances, the old brick (or a portion of them), after removal, have been relaid on the existing concrete base. There are also projects where a new brick top course has been laid on an old two-course concrete base pavement without removal of the original surface. This may be considered as resurfacing a concrete base although there is an old intervening course.

Base Preparation.—The question of the adequacy of the old base in place arises as in the case of resurfacing concrete pavements. It can likewise be advanced that, similar to an old pavement, an old base has inherent attributes in its favor. City streets differ from highways in that, because of underground drainage systems the subgrade conditions are usually more favorable; also established curb grades in most cases limit or preclude raising the elevation of the new surface.

Concerning the concrete bases in Lima, Ohio, on which large areas of brick pavements have been salvaged and relaid there is the following comment:

"If the base is bad in places we replace and properly re-enforce it, so there will be no danger of settlement. We do not feel especially concerned about the quality of the base. That base has been in there for twenty-five or thirty years and we feel that its weakness, if any, has been revealed long since. The ground beneath it is established and hard-packed, and we do not feel there is any chance for the base to settle any more except in case of service cuts."

Gutter Construction.—On concrete base resurfacing projects, it is frequently not possible—or undesirable from the standpoint of economy—to raise the old curbs to provide sufficient gutter. In some cases the original curb height was ample to allow for additional surface depth. When this is not the case and the new surfacing is brick, the difference to be taken care of can be eliminated or minimized by the use of a tapered or wedge shaped brick as the gutter line. Such a brick for example would taper from 3 inches at one end to 2½ or 2 inches at the other. Several courses of thinner brick are then laid at the curb to give the required gutter section. If necessary, the depth of cushion course can also be decreased—one-half inch being quite feasible especially with bituminous mastic.

Relaying Brick on Concrete Bases.—There is no difference between this type of resurfacing and what has been referred to previously as replacement except that instead of new material for the new surface course the old brick are re-used in whole or in part. Brick is unique in this respect among manufactured paving materials. Of course, new filler and usually new bed material are required.

As the removing and cleaning of the old brick before relaying is entirely a labor item, the cost will vary with the wages paid. The cost of cleaning is also dependent upon the type of filler used in the original construction. The extreme conditions would be represented by sand filler and a rich cement grout filler.

In most of the old brick pavements the brick were laid "on edge," that is, with the greater cross-sectional dimension vertical. When relaid they are usually laid flatwise, according to present day practice, and there is a gain in surface area. This fact affects the percentage of salvage measured by the area covered by the relaid brick. In some cases this has actually resulted in a salvage greater than 100 per cent and a surplus of brick which were used for additional paving. The general average is 75 to 80 per cent. Due to the increase in manufacturing costs since the brick pavements were originally constructed 20 to 30 years ago, the relay value of the brick is in many cases materially greater than the original cost.

Records show that a considerably larger proportion of old brick pavements have been relaid on reconstructed bases of the flexible type and on new concrete bases

Mastic Cushion Is Lightly Rolled After It Is Struck Off

Brick Are Rolled with a Three-Ton Roller

than on old reconstructed concrete bases. This is because most of the older brick pavements were laid on stone, gravel or sand bases, which in many cases were simply a thin bedding course over the earth subgrade. Excellent results can be secured in relaid brick pavements if care and skill are used in their construction. Many of these projects have the appearance of new brick pavements.

Conclusion

In considering the reconditioning of an existing pavement there is the broad question as to when it is advisable to take the step. Without considering the widening feature, it has been said that a pavement should be reconstructed when it is at the end of what has been termed "its economic life." Dean T. R. Agg, well-known highway economic authority, has said that, "At the end of its economic life, the roadway surface has deteriorated to its salvage value." He adds that, "It is conceivable that by careful maintenance a roadway surface might be continued in service after it had attained its economic life but the cost of maintenance would be such that it

Spreading Filler with Squeegee Buggies

would prove economical to replace the roadway surface instead of endeavoring to prolong its life." Whenever the cost of service from an existing surface is greater than from a new surface the economic life of the old surface has been exceeded. The theoretical economics of the problem of resurfacing only, are complicated by the desirability or necessity for widening. To provide a greater pavement width may be the major reason for the improvement. Also for economic reasons it may be advisable to resurface at the same time instead of postponing this operation for several years. The need for widening is of course determined by the volume and character of traffic.

Cost figures given in the report before the Highway Research Board, December 2, 1932, from which this article was abstracted, indicate that in some cases the cost of resurfacing and widening concrete pavements with brick has approached the cost of replacing the old pavement with a widened pavement of the same type. The justification for such a procedure must rest upon the grounds that greater service can be secured from the new two-course pavement structure with a brick surface. It should be more economical on the basis of annual cost, considering maintenance, depreciation and life expectancy. It is not considered appropriate to discuss this phase of the subject here but the author is firmly of the belief that this unquestionably is the case.

In addition to its economic justification the resurfacing of old pavements of any type has an appeal to the public that highway administrators would do well to recognize. Powerful opposition to highway transportation and the maintenance of the highway program has been manifest recently. A criticism frequently heard is that the public has been deceived regarding the life of highways—that they are wearing out before they have been fully paid for. However, when an old pavement is resurfaced it logically can be maintained that it is not being thrown into the discard. The original investment is being preserved and the old pavement will continue to serve for many years as a necessary part of a new paving structure of a higher type.

Summary

1. Resurfacing of concrete pavements has to date had its principal application to concrete highways not streets. Illinois has resurfaced about 120 miles in the last two years.

2. Old concrete slab should be adequate structurally or properly strengthened before resurfacing.

3. The stability developed in the old pavement structure through the years of its existence with proper maintenance is an important advantage.

4. Reasons why resurfacing increases service value are not primarily structural.

5. Design details vary principally because of the method of accomplishing widening and the desirability of connecting the curb and widening with the existing slab.

6. Materials used to correct irregularities in old slab act as a filler.

7. Bituminous mastic bed is especially applicable

8. Expansion joints in brick pavement with bituminous filler are not considered necessary.

9. Excavation for widening curb can be performed with power drawn equipment.

10. Cost data of brick resurfacing over concrete, as such, can not be segregated from items not primarily inherent to the resurfacing operation.

11. Concrete bases have been resurfaced with brick by replacing old surfaces, by relaying the old brick, or with a new brick surface over an old two-course pavement.

12. Adequacy of the old base must be considered.

13. Examples of brick resurfacing over two-course pavement not numerous.

14. Tapered brick and thinner cushion can be used at gutters.

15. Cost of removing, cleaning and relaying brick varies with labor wages and type of filler.

16. Salvage averages 75 to 80 per cent with 100 per cent in some cases due to gain in area.

17. Costs for relaying have been as low as $0.50 per square yard.

18. Existing pavement should be resurfaced when it has attained its economic life.

19. Brick resurfacing must justify itself on economic grounds.

▼

Gas Tax Cut Voted Down

Voters of Colorado at the November election turned down a proposal to reduce the gasoline tax from four to three cents, by a vote of two to one. The proposal carried in only one county, a county in which the highway program is nearly finished. A strong fight had been waged by certain interests to reduce gasoline taxes in this state as a precedent for a national campaign.

The U. S. Bureau of Public Roads

ITS CREATION # IN REVIEW **ITS PROGRESS**

ORGANIZATION AND ACTIVITIES OF BUREAU PROMOTE HIGHWAY DEVELOPMENT

HIGHWAY progress and the advancement of the science of highway engineering owe their success in no small degree to the honest efforts and active administration of the U. S. Bureau of Public Roads. This bureau has had a continuous existence as a branch of the U. S. Department of Agriculture since 1893 in a gradually evolving sphere of activity and has grown under several different names.

The Secretary of Agriculture created the office in that year to carry out an act of Congress that appropriated $10,000 to enable the secretary "to make inquiries in regard to the system of road management throughout the United States, to make investigations in regard to the best methods of road-making, to prepare publications on this subject suitable for distribution and to enable him to assist the agricultural colleges and experiment stations in disseminating information on this subject. * * *."

It was known at first as the Office of Road Inquiry.

From its creation until 1912 investigation and education, only, were the bureau's functions. It was during this period that the bureau and a small group of pioneer state highway departments laid the foundations of modern scientific highway construction. At the beginning there were only two state highway departments, and they were only just created, in Massachusetts and New Jersey. Actual creation of many other departments is due to its suggestion.

Mr. A. E. Palen, District Engineer, U. S. Bureau of Public Roads, prepared the following information about the bureau, which was published in *Colorado Highways*: In these years of its early history, while it was studying and investigating and teaching others how to build good roads, it was also preparing itself for the opportunity which came to it in 1912, at first in a small way, to assume the direct responsibility for the construction of roads paid for in part by the United States.

It was the Postoffice Appropriation Act for the fiscal year 1913 that launched the bureau upon its new career of responsible road building. The act provided an appropriation of $500,000 to be expended by the Secretary of Agriculture in cooperation with the Postmaster General for the improvement of post roads to be selected by them.

It was about this time the bureau also began its activities in the West in the national forest states through supplying the engineering supervision for the first program of forest road construction made possible by 10 per cent of national forest receipts being devoted to road work.

Importance of Federal Aid Legislation of 1916.—This initial experience in the administration of large construction expenditures was of great value to the bureau when, as a result of the passage of the Federal Aid Road Act and its approval by the President on July 11, 1916, it was called upon to cooperate with the highway departments of the several states in a larger program.

This far-reaching piece of legislation provided an appropriation of $75,000,000 to be expended in five years for the improvement in all states of roads "over which the United States mails now or may hereafter be transported * * *."

More important than the federal funds appropriated by the act were certain of its other features, and most important of all was its requirement that each state, to share in the appropriation must first establish a state highway department adequate in the opinion of the Secretary of Agriculture to cooperate with him in the administration of the improvements provided for.

The act contained other provisions, then novel, which have abundantly demonstrated their wisdom in the succeeding years. It prescribed a definite mathematical formula for the apportionment of thef ederal appropriation among the states. It provided that the money was to be divided: One-third in the proportion of the area of the states, one-third in the proportion of their population, and one-third in the proportion of their respective mileage of rural post roads and star routes. It limited the amount payable by the government on any road to 50 per cent of the cost and not more than $10,000 per mile exclusive of the cost of bridges more than 20 feet in span.

It gave the states the initiative, subject to the approval of the Secretary of Agriculture, to determine the roads to be improved and the character of the improvement. And, after improvement, it demanded of the states that

Typical Low Cost Road, Coarse Aggregate Type Road—Mix Approved by the Bureau.

they assume the obligation of maintenance and provided means for insuring that the obligation would be carried out. In the Secretary of Agriculture it reposed the final authority to determine the adequacy of the improvements and to grant or withhold the federal assistance accordingly.

In only one respect was this act materially defective. The defect lay in the fact that it permitted too wide a dispersion of the federal money, so that there could be no assurance of the completion of connected arteries in any reasonalble time. This defect was corrected by the Federal Highway Act, approved Nov. 9, 1921, most important of the amendments of the original act, and in itself the most significant piece of federal highway legislation in the history of the United States.

Legislation of 1921 Caused Federal Aid Systems.—The Federal Highway Act retained all of the outstanding features of the earlier act, and added the important requirement that the Secretary of Agriculture and the several state highway departments should jointly designate a system of important interstate and intercounty roads limited to 7 per cent of the country's total road mileage, to constitute the federal-aid highway system, upon which all future federal appropriations should be expended. This system, as designated to date, includes approximately 200,000 miles of road, of which about 101,000 miles have been initially improved with federal aid.

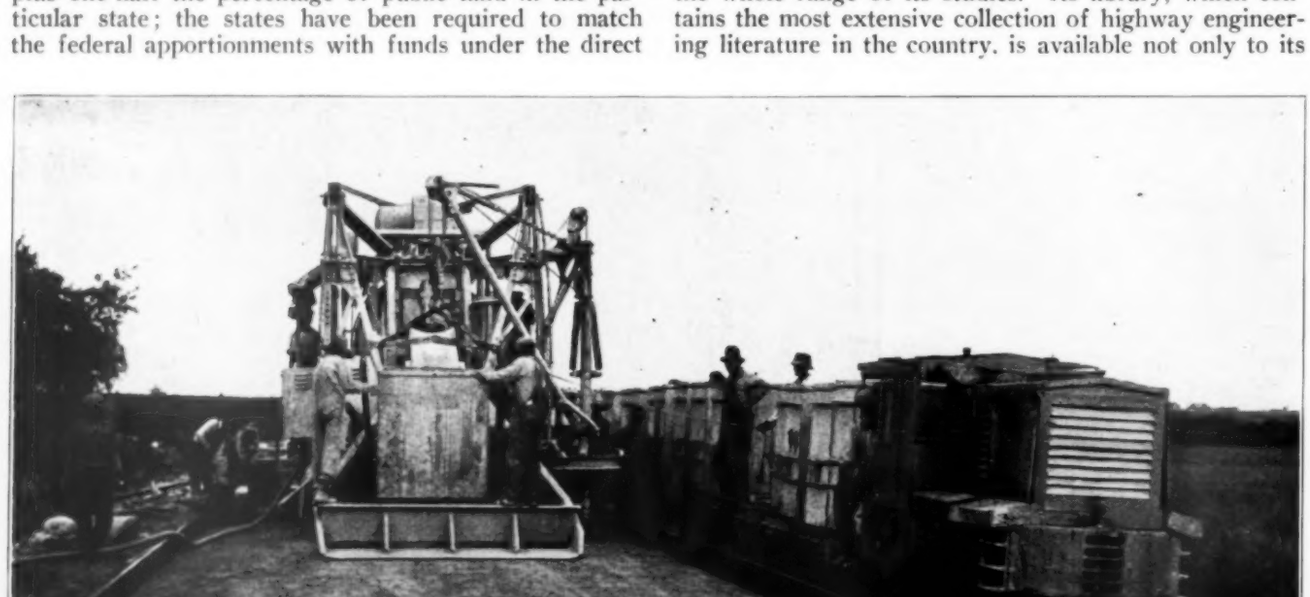
By other important amendments the maximum amount payable by the federal government has been increased to $25,000 per mile under certain conditions: The proportion payable by the United States in states of whose area more than 5 per cent is federally-owned public land has been increased from 50 per cent to 50 per cent plus one-half the percentage of public land in the particular state; the states have been required to match the federal apportionments with funds under the direct control of their highway departments; and the maintenance provision has been strengthened.

Organization of Bureau Described.—When it was created in 1893, the Bureau of Public Roads, then called the Office of Road Inquiry, had an annual appropriation of $10,000, and its entire organization consisted of a special agent and engineer and a small clerical force. The functions of the office were restricted to such study as the small organization could find time for, in view of the other duty imposed upon it to disseminate the results of its studies. Today the entire organization of the Bureau of Public Roads includes nearly 1300 persons, of whom over 500 are engineers. These workers are all engaged in highway work of the bureau, its principal activity.

Besides its major task of administering jointly with the state highways departments the federal-aid road program, the bureal also constructs the principal roads in the national forests, and cooperates with the National Park Service in the construction of the main roads in national parks.

To solve the numerous technical problems that are constantly arising in its construction work and to extend the frontiers of the science of highway engineering, it carries on a program of highway research, the most comprehensive of its kind under any single agency, independently and in cooperation with the state highway departments, with universities and with other agencies.

In line with one of the first duties imposed upon it, the bureau endeavors at all times to disseminate promptly the results of its studies. To this end it publishes a monthly research periodical which circulates throughout the world as one of the most authoritative journals in its field. It also publishes numerous reports and bulletins covering the whole range of its studies. Its library, which contains the most extensive collection of highway engineering literature in the country, is available not only to its



Through Research and Management Studies Made by the Bureau on This Type of Work Highway Progress Was Materially Advanced.

own staff, but to all persons who wish to make use of its facilities for study.

To carry out these various lines of work, the bureau has a headquarters organization at Washington, headed by the Chief of Bureau. The chief engineer has charge of all federal-aid road work. Advising and assisting the chief of bureau and the chief engineer in the federal-aid administration, are staff divisions of design, construction and bridges, each headed by a chief, with headquarters at Washington.

The bureau has direct contact with state highway departments through its district organizations, of which there are 12, each in charge of a district engineer. Eleven of the districts include from two to eight states. District No. 11 covers the territory of Alaska, where the only activity is forest road construction. The bureau also maintains in most of the states, as a part of the district organization and as a still more direct contact with highway departments, a state office under a responsible engineer who works in close cooperation with the highway department.

At San Francisco there is a regional headquarters for the administration of federal aid to the western states, and for national forests and national park road work, under the direction of a deputy chief engineer, to whom the district engineers of the five western states report.

For the conduct of its research work, the bureau has three divisions at Washington: The Division of Tests, which deals with the physical problems involved in the characteristics of road materials, and the forces of traffic and climate that affect road structure and design; the Division of Highway Transport which deals with questions of highway finance, and the economics of highway service; and the Division of Management which studies the economic aspects of road construction processes with the object of reducing their cost and increasing their efficiency.

The Division of Control, which includes the accounting section, keeps the necessary control accounts showing the status of federal aid. These records show, day by day, the amount of aid applied for by each state, the sum allotted, and the amount paid to each state. These figures are kept strictly up-to-date.

The Legal Division, in addition to its advisory functions in connection with administration of bureau activities, handles details of preparation and execution of contracts and of related matters pertaining to federal-aid and forest road construction work, and also makes studies and gives advice concerning state and federal highway legislation.

The Division of Information is the agency through which information is given to the public in various ways —through correspondence and bulletins, through exhibits, motion pictures and other means. The division is also responsible for the editing and publication of the bureau's research magazine, "Public Roads," referred to above.

District Organizations.—The organization established by the Bureau of Public Roads in the different geographical districts of the country for the purpose of carrying out the provisions of the Federal Highway Act are in charge of district engineers who are administrative and technical heads of the organizations. A district organization consists of a headquarters office and, where necessary state offices in each of the states embraced in the district.

The headquarters office is divided into administrative and engineering sections. The administrative section consists of the clerical personnel necessary in preparing correspondence, reports, accounts, et cetera, in connection with the work. The engineering section is made up of different groups of engineers performing related tasks. The bridge division is charged with the responsibility of reviewing and passing upon all matters relating to structures on federal-aid projects. Similarly, the plans division is responsible for reviewing and passing upon all details in connection with the roadway portion of federal-aid projects, including the examination of estimates of cost, specifications and contracts.

Other general office activities are in charge of an office engineer who exercises general supervision over the work of a material engineer, a statistical engineer and the clerical personnel. The work of the materials engineer has to do with the location, selection, examination and maximum utilization of available construction materials; while that of the statistical engineer consists of gathering and assembling of information from the various state highway departments and political subdivisions of the state concerning highway activities, finance, construction, etc.

The state offices are in charge of senior highways engineers with one or more engineering assistants and clerical help. They were established to facilitate the selection of routes, to assist in the preparation and approval of plans, to enable a greater measure of general supervisory control to be exercised over construction work on federal-aid projects and to better determine whether completed projects were being properly maintained.

The initial experience in the administration of the Federal Aid Road Act demonstrated the desirability of establishing close contacts with the states in the formulation and preparation of plans for the work to be undertaken with federal cooperation. Such contacts enable virtual agreements to be reached in regard to all controversial matters before detailed plans have been prepared. There is a considerable waste of time and energy in making changes in plans after they have been completed. Except for the close relationship existing between the representatives of the district offices of the bureau and the state highway departments, it would be necessary for them to proceed with the selection of routes and preparation of plans and risk the possibility that exception would be taken to certain features and revisions required upon submission to the bureau for approval. These difficulties are obviated and the procedure speeded up by maintaining bureau representatives in the state, who have authority to agree on general features of location and design which are in conformity with established engineering practice.

Differences between the states and the state representatives of the bureau are referred to the district office for decision. Representatives from the state offices of the bureau make frequent inspections of construction work on federal-aid projects to determine the amount of work done for reimbursement and its conformity with the specifications. Regular inspections are also made of completed work to insure adequate maintenance. The engineering assistants in the state offices receive instructions from the engineers in charge of the states to perform any work required by regulation or special assignment.

The principal functions of the district organizations are to administer the federal highway act under which the national government cooperates with the states in the improvement of highways on a designated system of highways within the states and undertakes the construction of roads within the national forests and parks. Their lesser functions are to gather and assemble information concerning the highway activities of the various states and their political subdivisions, to collect and pre-

pare information on highway legislation, sources of highway revenues, motor vehicle registrations, methods of financing used by different states, to cooperate with the states in the location and utilization of materials which may be suitable for road building purposes, and, upon request, to advise state and county officials on the solution of highway problems. The district organizations were established for the purpose of exercising close administrative control over the personnel of the bureau assigned to work in the different states and to pass upon routine matters concerning administrative and general engineering matters without reference to the Washington office. The states are permitted to proceed with construction on federal-aid projects on the recommendation of approval of plans by the district engineers. Federal funds may be used to pay for work done after the recommendation of approval is given. The district organizations exercise general supervisory control over all federal-aid work undertaken in the respective districts and are guided by definite administrative and general engineering policies. They contribute to the successful carrying out of the Federal Highway Act by rendering prompt service and decisions on all matters

Curve Correction and Relocation, One of the Safety Features Demanded on Federal Aid Roads.

which arise without the delay incident to referring such matters to the Washington office.

The district engineers establish frequent personal contacts with the administrative officials of the state highway departments in the district and endeavor to adjust all differences of opinion which may arise concerning the applications of the Federal Highway Act. The administrative officials of a number of the state highway departments are subject to frequent changes. These changes often bring into office individuals who are new to highway problems. The district organizations often render a real service to these officials in supplying information concerning sound principles of administration and construction and maintenance practices of proven value.

National Forest Highways Activity.—Another important activity of the certain districts is the construction of forest highways and for which in a western district, together with the construction of national park highways, the greater portion of the organization is required. Except for the 10 per cent fund, previously mentioned, regular federal funds for the construction of forest roads and trails became available for the first time upon the passage of the Federal Aid Road Act and its approval by the President on July 11, 1916. Section 8 of this act provided an appropriation of one million dollars per annum for ten years to be "expended under the supervision of the Secretary of Agriculture, upon request of the proper officers of the state, territory or county for survey, construction and maintenance of roads and trails within or partly within the national forests when necessary for the use and development of resources upon which communities within and adjacent to the national forests are dependent."

Construction of forest roads proceeded under the authority of this act until the close of the World War when Congress, in order to provide employment for returned veterans, amended the Federal Aid Road Act and appropriated an additional three million dollars a year for three years for forest road construction. This amendment, which was approved Feb. 28, 1919, authorized the Secretary of Agriculture to proceed in the survey, construction and maintenance of forest roads and trails without cooperation of the local authorities provided the work was necessary for the proper administration and improvement of national forests or that the work was of national importance. It also provided for the transfer and use in forest road construction of war surplus material, equipment and supplies, suitable for the purpose.

Responsibility for the survey and construction of forest roads authorized under these acts was delegated by the Secretary of Agriculture to the Bureau of Public Roads which developed an organization adequate to handle the work economically and efficiently.

The Federal Highway Act, approved Nov. 9, 1921, provided an increase in the annual appropriations for forest roads and made provision for the designation and approval by the Secretary of Agriculture of two distinct classes of forest roads, namely, forest development roads and forest highway, and established a basis upon which future appropriations should be apportioned for these two classes.

Roads and trails of primary importance for the protection, administration and utilization of national forests or for the use and development of the resources upon which communities within or adjacent to the national forests are dependent, were designated forest development roads.

Roads of primary importance to the state, counties, or communities within or adjacent to the national forests were designated forest highways.

After the passage of the Federal Highway Act the state highway departments of the states in which national forests are located made a study, in cooperation with the Bureau of Public Roads and the forest service, of the highway situation in the forest areas and designated a forest highway system for each state. These systems have been approved by the Secretary of Agriculture and consist of a total of more than 16,000 miles, located in 31 states, Alaska and Puerto Rico.

A study of the needs for roads of primary importance to individual forests was made by the forest service, and the system of forest development roads, recommended by the forester, has also been approved by the secretary. This system includes all existing or proposed roads within or adjacent to and serving the forests and which are designated as forest roads by the forester.

The forest highway system is divided into classes 1, 2 and 3; class 1 being roads on the federal-aid system or extensions thereof which are wholly within the forests; class 2, roads on the federal-aid system or extensions thereof which are partly within or adjacent to national forests; and class 3, roads which are of primary importance to counties or local communities and which are within or adjacent to the forests.

Annual construction programs for both forest devel-

opment roads and forest highways are prepared and submitted to the Secretary of Agriculture for approval. The forest development road program is prepared in accordance with the needs of individual forests and is submitted to the secretary by the forester. The forest highway program is prepared as a result of conferences between the state highway departments, the Bureau of Public Roads and the forest service.

In arriving at this program of construction consideration is given to projects which will improve existing roads or provide new roads where most urgently needed and where construction of adequate roads will be of greatest benefit to traffic.

Responsibility for the prosecution of the work outlined in the forest highway program is vested in the Bureau of Public Roads; and all work incidental to making surveys, plans and estimates, and handling all details of construction is carried out by this organization. The bureau also has supervision and control of all forest development projects where the services of an engineering organization are required, or where the estimated cost of the work is $5,000 per mile or more.

Maintenance of forest highways is undertaken by the federal government for a period of two years after construction in order to assure the integrity of the work during the period of most rapid deterioration and by the state or county thereafter. Frequent inspections are made by the Bureau of Public Roads to insure adequacy of maintenance.

Due to the fact that most of the national forests are in mountainous country and usually at high altitudes the location of forest roads is difficult, and the construction heavy. In many cases, however, these roads are links in very important state or interstate highways and their early construction is highly important in order to provide through traffic lanes from one section of a state to another or from one state to an adjoining one. In many cases forest highways provide the only approach roads to the national parks and for this reason their early construction to an adequate standard is highly desirable.

Road Construction in National Parks Supervised by Bureau.—Since 1924 the engineering services of the Bureau of Public Roads have been employed at the request of the national park service for the survey, construction and improvement of roads and trails in the national parks and national monuments. The work involved fits in well with the other duties of the bureau, which supervises similar activities in the national forests, many of which are adjacent to the parks. Since 1926 the cooperative relationship between the two federal agencies has been maintained under a standing agreement entered into in February of that year.

▼

Another Curiosity of Figures

$1 \times 9 = 9 = 9$
$9 \times 9 = 81 = 9$
$81 \times 9 = 729 = 18 = 9$
$729 \times 9 = 6561 = 18 = 9$
$6561 \times 9 = 59049 = 27 = 9$
$59049 \times 9 = 531441 = 18 = 9$
$531441 \times 9 = 4782969 = 45 = 9$
$4782969 \times 9 = 43046721 = 27 = 9$

And so on ad fin.

H. M. Bacon.

58 Sutter St., San Francisco.

Interviews Show Diversion Opposition

In the late spring of 1932 the Griswold-Eshleman Co. of Cleveland had occasion to make a survey on "The Public Attitude Toward Highway Construction in Ohio." They prepared a questionnaire so that the questions would not suggest the answers and so worded it that the person interviewed would not be able to tell for whom the survey was being made. Thus the answers were impartial and unbiased.

Following the method used by the country's leading marketing analysts, interviews were secured with people concerning the public attitude towards gasoline tax diversion largely through the cooperation of leading colleges and universities. The company was able to secure the assistance of such men as Professor O. J. Marsh, Department of Business Administration, Cleveland College; Professor D. J. Hornberger, head of the Department of Business Administration, Ohio Weslyn University, Delaware, Ohio, and Professor C. H. Sandage, School of Business Administration, Miami University, Oxford, Ohio. These men secured the services of the college students who acted as interviewers, and supervised the work.

Answers were not desired from any one group of people but it was hoped to have replies represent a true cross section of the public. For this reason, persons interviewed were selected at random but they did ask that interviews be secured preferably from men and preferably from men who were property owners. Persons were interviewed at their homes and at their places of business.

The company received 1170 questionnaires with the following geographical distribution:

Cuyahoga County ...	285	Lorain County.....	87
Columbiana County..	10	Montgomery County..	153
Butler County.....	176	Miscellaneous	83
Delaware County....	376		

These represent counties in all parts of the state. Of the persons interviewed, 61.4 per cent were property owners and 82.6 per cent were men.

One of the questions asked was:

(a) Do you believe in spending money already appropriated for maintaining and extending our state highway system?

(b) Or should this money in your opinion be diverted to relief or other purposes?

It was found that 82.2 per cent of those interviewed were in favor of spending money appropriated, that is, gasoline tax and license-fee funds, for strictly highway building and maintenance. 14.3 per cent were in favor of diversion; 3.2 per cent had no opinion on this question.

Some question might be raised as to whether the 1,170 persons interviewed represent a fair sample of public opinion. The company believes that it does and one of their reasons for this belief lies in the fact that they analyzed the first six hundred questionnaires which came in and compared their results with the answers for the entire group. In no case did the percentages of the two groups vary more than 4 per cent. They believe that an analysis of three or four thousand questionnaires would have given the same result. It is also interesting to note that in repely to the gasoline tax diversion question the percentage of replies from various counties did not vary more than a few per cent.

State and County Highway Construction in 1932 and 1933

Reports from Highway Officials Showing Probable Expenditures

New England States

Maine

Funds for 1933 for the State Highway Commission will depend on whatever action the legislature takes this winter. There remains $2,000,000 of bonds to be issued for highways whenever the legislature authorizes the sale of these bonds and $1,000,000 of bonds for bridge construction. It is possible that should authorization be given the amounts may be extended over a period of two years, that is, for 1933 and 1934.

The commission has been using Federal Aid largely in connection with state highway funds, that is the bond funds, and of course it is not known at this time what the Federal allotment will be.

The commission's other work consists of state aid road construction, third class road construction and maintenance. It has a general highway fund which includes all income for this department outside of bond funds. From this fund it has to take care of the above items and also payments covering the interest and retirement of bonds and fixed charges, these fixed charges amounting to about $675,000. On the basis of estimates of income under the present laws it is estimated at $8,245,000. There is right now some talk of cutting two appropriations which go into this fund. Should this happen it is probable that the general highway fund will not amount to over $7,220,000.

L. D. Barrows, Augusta, Me., is chief engineer State Highway Commission.

New Hampshire

The total expenditures for all purposes in 1932 under the direction of the state highway department is estimated to be $6,200,000. It is estimated that the probable expenditures for all purposes in 1933 will be $5,500,000.

F. E. Everett, Concord, N. H., is state highway commissioner.

Vermont

State highway completed in 1932 included 41 miles of road mix; 27 miles of bituminous macadam and 27 miles of portland cement concrete. Work involving approximately 28 miles of first stage grading, base and drainage was carried over to 1933. Details of the work completed in 1932 are given in the tabulation.

Vermont state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	27.047	18	7	$30,000
Bituminous Macadam	27.194	18	3	16,000
Bituminous, Road Mix	41.450	18	2½–3	15,000 to $5,000

No information is available as to the 1933 program until after the legislature takes action.

Herbert E. Sargent, Montpelier, Vt., is commissioner of highways.

Massachusetts

Nearly $28,000,000 was expended in 1932 under the supervision of the state highway department. No information will be available on probable expenditures for 1933 until legislature makes appropriations. A. W. Dean, Boston, Mass., is chief engineer, state department of public works.

Rhode Island

The expenditure for state highway construction in 1932 amounted to $2,000,000. The probable expenditures for construction in 1933 also will be $2,000,000. Details of the state highway completed in 1932 follow.

Rhode Island state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	10.0	20	8	$40,000
Bituminous Macadam	6.0	20	8	30,000
Gravel	3.6	20	8	10,000
Sheet Asphalt*	1.3	44	3*†	70,000
Graded and Drained†	5.8	44	.	.....

*On 6-in. concrete base. *†3-in. top. †No pavement will be placed on this before late 1933 or 1934.

The work shown below has been in progress since late fall and will comprise practically all the 1933 program:

Types	Miles		Probable Expenditure
P. C. Concrete	10.90		$500,000
Bituminous Macadam	16.76		500,000
Gravel	30.00	(est.)	160,000
Sheet Asphalt on Concrete Base	3.34		300,000

G. H. Henderson, Providence, R. I., is chief engineer, State Board of Public Roads.

Connecticut

State highway completed in 1932 included 33.3 miles of 20 ft. wide, 8-in. thick concrete road, 14.57 miles of 20 ft. 8-in. thick bituminous macadam; 49.93 miles 20 ft., 7-in. thick plain macadam; 251.15 miles 14 ft. gravel road and 5.3 miles graded and drained road.

J. A. MacDonald, Hartford, Conn., is state highway commissioner.

Middle Atlantic States

New Jersey

A summary of the construction performed for the state highway department follows:

91.769 miles of reinforced concrete pavements were completed during 1932. The width of these pavement surfaces ranged from 20 feet to 76 feet. The average widths were 20 feet, 30 feet, and 40 feet, depending on the location and importance of the route, and the depth of pavement ranged from 8-in. to 10-in., mostly 9-in.

The last analysis made by the department of representative standard modern highway construction projects with 9-in. reinforced concrete pavement 20 ft. wide with 10 ft. shoulders, graded 40 ft. and in some cases 50 ft. wide, throughout the several territories of the state, exclusive, however, of work in the metropolitan area and construction of so-called super-highways, which, of course, are not representative nor comparable to general highway construction work, indicates that the cost per mile on an average is about $50,000, exclusive of bridges and right of way. The average cost of ordinary bridges runs about $10,000 per mile.

In addition 52.278 miles of concrete pavement construction, .8 miles of asphalt pavement, and 9.669 miles of grading work were carried over into 1933. There will also be considerable bridge work.

It is not definitely known what the program for 1933 will be, but from the tentative program made up it may

be expected that 60.2 miles of concrete pavement will be placed under contract for construction during 1933, representing an expenditure of $7,714,560. The tentative program also calls for an expenditure of $18,470,231 for right of way and construction of bridges and viaducts, making up a possible total commitment for 1933 of $26,184,792.

Approximately $15,600,000 was committed for road and bridge construction and right of way in 1932.

J. L. Bauer, Trenton, N. J., is state highway engineer.

Pennsylvania

It is not possible to give any definite information at this time, concerning next year's program of the state highway department, as it will be entirely dependent upon the money made available for highway construction and maintenance by the 1933 session of the General Assembly, which convenes in January.

Illinois

Expenditures in 1932 approximated $28,800,000. Probable expenditures in 1933 for state highway construction are $29,000,000. Frank T. Sheets, Springfield, Ill., is chief highway engineer.

Michigan

Construction expenditures in 1932 were approximately $21,000,000. Carryover projects to 1933 and work authorized but not awarded will amount to about $6,000,000. An additional $3,000,000 probably will be available for construction in 1933.

East North Central States

Indiana

The annual report has not yet been entirely completed, but the records show that the division of construction built 388 miles of high type pavement of which a small percentage was more than two lanes in width, so that the equivalent mileage of two-lane pavement was slightly less than 400 miles. During the same time it constructed 49 miles of heavy grading and drainage projects. These figures refer to the fiscal year which ends Sept. 30.

Road and bridge lettings were held in late November, totaling approximately $2,500,000 of which 95 miles was paving and 11 miles was heavy grading. It seems probable that perhaps 150 miles more of high type paving can be constructed in 1933, although this will depend largely upon the weather conditions prior to June 30 when the Federal Emergency Relief Funds are no longer available and also upon the action of Congress with regard to the appropriation of normal Federal Aid funds.

It seems probable that the bridge program for 1933 will approximate $2,000,000, which is slightly less than the program for 1932. During the past year three interstate bridges were completed. Two of these were across the Wabash River opposite Vincennes, Ind., and Mt. Carmel, Ill., respectively, while the third was across the Ohio River between Henderson, Ky., and Evansville, Ind.

Wm. J. Titus, Indianapolis, Ind., is chief engineer state highway commission.

Wisconsin

State highway construction completed in 1932 included 380 miles of portland cement concrete; 255 miles of mixed in place road, and 251 miles of gravel and crushed stone road. Details of the work are given in the accompanying tabulation.

Wisconsin state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	380	20	9-6½-9	$29,200
Gravel and Crushed Stone	251	30	5	3,700
Bituminous, Plant Mix	24	21	4	11,000
Mixed in place	255	24	5	3,200
Graded and Drained	302	..	.	8,100

The uncompleted work carried over to 1933 included 120 miles of portland cement concrete, 42 miles of grading; 14 miles of gravel are 10 structures. The total expenditures for construction in 1932 including that for uncompleted work was $13,000,000. The probable expenditure in 1933 will be $10,000,000. The proposed new construction (the information, however, not being complete at this writing) is as follows:

Types	Miles	Probable Expenditure
P. C. Concrete	140	$4,200,000
Bridges and Grade Separations	15	1,100,000
Gravel	98	695,000
Bituminous, Plant Mix	87	487,000
Mixed in Place	..	.....
Graded and Drained	57	698,600

J. T. Donaghey, Madison, Wis., is state highway engineer.

West North Central States

Kansas

State highway completed to Oct. 1, 1932, included 82.9 miles portland cement concrete; 308.7 miles gravel and 217.7 miles bituminous mix. The table gives some detail of the work.

Kansas state highway completed in 1932; to Oct. 1:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	82.9	20	9–7–9	$26,356.85
Gravel	308.7	30	3	620.27
Bituminous Mix	217.7	26	1	2,461.18
Graded and Drained	128.4	30	.	11,656.25

The uncompleted work carried over from Oct. 1, 1932, was as follows:

Types	Miles	Contr. + 10%
Earth and Culv	304.0	$2,114,961
Oiled Earth Surface	14.9	11,219
Sand Gravel	388.0	357,825
Bit. Mat. Surf	709.7	1,698,824
Bit. Retread	13.2	78,638
Concrete	50.7	1,255,037

It is not possible at this time to make any forecast relative to the work that may be done in 1933.

W. V. Buck, Topeka, Kan., is state highway engineer.

Missouri

The tentative program of the state highway department for 1933 includes 1845 miles of earth grading, 1517 miles of gravel surfacing, 191 miles of oil mat, 87 miles of retread surfacing, and 494 miles of concrete pavement. The construction program for 1933 will approximate $22,700,000 of new work.

T. H. Cutler, Jefferson City, Mo., is chief engineer, state highway department.

North Dakota

The state highway completed in 1932 included 805 miles of gravel road; 48 miles of bituminous plant mix, and 8 miles of road mix. The accompanying tabulation gives some detail of the 1932 work.

North Dakota state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	8	20	9–7–9	$29,000
Gravel	805	20	4	1,300
Bituminous, Road Mix	8	20	3	5,000
Bituminous, Plant Mix	48	20	3	5,000
Graded and Drained	373	24 and 36	.	3,000

The uncompleted work carried over to 1933 includes 422 miles of gravel road, 3.7 miles of bituminous road

mix, 130 miles of plant mix, 1.4 miles of concrete and 407 miles of graded and drained road.

The proposed new construction for 1933 includes 250 miles of gravel road refining a probable expenditure of $330,000; 50 miles of bituminous plant mix, $250,000; and 250 miles of graded and drained road, $750,000.

H. C. Frahm, Bismarck, N. Dak., is state highway engineer.

South Atlantic States

Delaware

State highway completed in 1932 included 43 miles of portland cement concrete, and 24 miles of slag macadam. The total expenditure for state highway construction in 1932 was $1,800,000. It is expected to expend a like amount in 1933. Details of the work are given in the accompanying tabulation.

Delaware state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	43	18 to 20	7 to 8	$25,000
Plain Macadam (Slag)	24	20	0	5,000
Gravel	3	20	0	4,000
Graded and Drained, Including Structures	15	..	0	5,000
Concrete Sidewalks	5	..	0	.....

The uncompleted work carried over to 1933 included 15 miles of slag macadam, 8 miles portland cement concrete, 10 miles portland cement concrete widening and 4 miles portland cement concrete dual road.

The proposed new construction for 1933 includes 50 miles of portland cement concrete and 100 miles of slag macadam.

W. W. Mack, Dover, Del., is state highway engineer.

Maryland

The total expenditure for state highway construction in 1932 was $9,812,725. The state highway completed in 1932 for the fiscal year ending Sept. 30 included 102 miles of concrete, 75 miles of gravel and 52 miles of bituminous macadam, same details which are given in the accompanying tabulation.

Maryland state highway completed in 1932 (fiscal year ending Sept. 30):

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	102	16	9–65–9	$30,000
Bituminous Macadam	52	16	8	20,000
Gravel	75	16	8	8,000
Bituminous, Plant Mix	3	20	2*	6,500

*On present road as base.

The uncompleted work on Sept. 30 included 42 miles portland cement concrete, 24 miles bituminous macadam, 13 miles of gravel and 68 miles of bituminous plant mix. It was expected that a large proportion of this work would be completed in the calendar year 1932.

It is impossible to give the construction program for 1933 until after the forthcoming session of the legislature.

H. D. Williar, Jr., Baltimore, Md., is state highway engineer.

North Carolina

The total expenditure for state highway roadway construction in 1932 was $2,388,877. In addition 56 bridges over 20 ft. span costing $120,833 were constructed. It is impossible to give a definite estimate of the amount of work that will be done in 1933. However, the probable expenditures for construction in 1933 of roadway are $3,842,410, with an additional expenditure of $560,000 for bridges. Details of state highway completed in 1932 were as follow.

Detail of state highway completed in 1932, the uncompleted work and proposed new construction are given in the tabulations.

North Carolina state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
Plain Concrete	2.96	18	8–6–8	$18,000
Trafficbound Macadam	47.59	18	6	8,300
Gravel or Crushed Stone	8.00	18	7	9,100
Mixed-in-Place	26.80	20	2½	6,680
Sand Asphalt	12.46	18	5	14,470
Bituminous Surface Treatment (including Trafficbound Macadam)	280.00	20	¾	3,000
Graded and Topsoil	15.36	20	7	9,300
Graded and Drained	48.18	..	0	6,700
Widening Existing Pav'm't	11.10	10	6	2,550
Patching and Retreatment only	193.50	18	0	1,070
UNCOMPLETED WORK CARRIED OVER TO 1933				
Trafficbound Macadam	47	18	6	$11,400
Gravel-Crushed Stone	25	18	7	10,800
Mixed-in-Place	33	20	2½	7,500
Sand Asphalt	12	18	5	12,250
Bituminous Surface Treatment (including Trafficbound Macadam)	159	20	¾	3,000
Graded and Topsoil	40	20	7	7,300
Graded and Drained	50	..	0	7,000
PROPOSED NEW CONSTRUCTION FOR 1933				
Plain Concrete	5	18	8–6–8	$18,000
Trafficbound Macadam	20	18	6	7,000*
Mixed-in-Place	20	20	2½	5,200*
Bituminous Surface Treatment (including Trafficbound Macadam)	150	20	¾	3,000
Graded and Topsoil	30	20	7	7,700
Graded and Drained	54	..	0	7,000

*Grading not included.

L. R. Ames, Raleigh, N. C., is state highway engineer.

South Carolina

The following information relates to the construction and maintenance activities of the state highway department for the year ending Sept. 30, 1932:

Construction expenditures		$9,374,362
Maintenance expenditures		1,314,384
Construction work completed during the year:	Miles	Miles
Concrete Pavement	266.1	
Bituminous Surfacing	216.6	
Earth Types	177.7	
Number Bridges	109	
Status of system as of Sept. 30, 1932:		
Completed—		
Standard Pavement	2,380.4	
Bituminous Surfacing	796.2	
Earth Types (improved)	1,662.0	4,838.6
Under Construction—		
Bituminous Surfacing	337.7	
Earth Type (improved)	28.8	366.5
Unimproved	758.7	758.7
Total State Highway System		5,963.8

No very definite forecast of the program for 1933 can be made at this time. No state funds have been available for new construction since the beginning of 1932. However, construction contracts, involving approximately $2,500,000, have been awarded since Aug. 31, 1932, from funds provided by the Federal Emergency Relief & Construction Act of 1932 supplemented by the state share of the 1933 regular Federal Aid apportionment. This work is known as the Emergency Program and includes the following projects:

Concrete Pavement	13 miles
Bituminous Surfacing	244 miles
Topsoil and Sand-Clay	20 miles
Bridges	2,077 feet

Chas. H. Moorefield, Columbia, S. C., is state highway engineer.

Georgia

The total expenditure for state highway construction in 1932 was $16,000,000. The state highway completed included 178 miles of concrete, 23 miles of bituminous plant mix and 485 miles of graded and drained road. The accompanying tabulation summarizes the work.

Georgia state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
Lime Rock Surface Treated	115	21	6–8	$12,000
P. C. Concrete	178	20	9-7–9	16,500
Brick	1.4	36	0	.....
Plain Macadam	...	..	0	.....
Gravel	45	20	6–8	4,000–$6,000
Bituminous, Road Mix	..	..	0	.....
Bituminous, Plant Mix	22.7	20	0	4,000–$9,000
Mixed in Place	...	..	0	.....
Graded and Drained	485	32	0	.....

The uncompleted work carried over to 1933 included the following:

Types	Miles
Concrete	43
Lime Rock, Surface Treated	68
Bituminous Types	51
Gravel	23
Grading	142

The construction program for 1933 has not been prepared as yet. The legislature meets in January.

B. P. McWhorter, Atlanta, Ga., is state highway engineer.

Florida

Total expenditures in 1932 were $7,513,000. Anticipated income for 1933 is between $9,000,000 and $10,000,000.

West South Central States

Arkansas

The status of the Arkansas state highway system on Dec. 31, 1932, was as follows:

	Miles Complete	Miles Under Construction or Commitment	Totals
Concrete Pavement	873.93	29.19	903.12
Asphaltic Pavement	571.60	.....	571.60
Asphaltic Retread	336.20	.....	336.20
Gravel	5,424 04	2.20	5,426.24
Graded	825.85	24.15	850.00
Unimproved	636.13	.....	636.13
Through Towns and Cities (unclassified)	175.11	2.25*	177.36
	8,842.86	57.79	8,900.65

*Concrete pavement.

The 1933 program will consist of grading, gravel surfacing, bituminous retread surfacing, portland cement concrete paving and bridge work. The following is a resume of the work:

Value of 1931 awards carried into 1933 (active and inactive)	$ 600,000
Value of 1932 awards carried into 1933 (active)	900,000
Amount available for construction Jan. 1, 1933	2,700,000
Total	$4,200,000

Construction funds for 1932 and 1933 are composed of the normal Federal Aid apportionment of $2,100,000 made available July 1, 1932, and matched with funds of the Emergency Relief and Construcion Act of 1932 in the same amount. Construction funds in 1933 will be augmented by the normal Federal Aid apportionment of $2,100,000 available July 1, 1933, if sufficient revenue is obtained to match such apportionment.

Value of road work under commitment Jan. 1, 1933	$800,000
Value of bridge work under commitment Jan. 1, 1933	700,000

W. W. Zass, Little Rock, Ark., is engineer of construction state highway commission.

Texas

During the fiscal year ending Aug. 31, a total of 2,305 miles of state highway was completed, the total cost being $24,693,519. The following is a summary statement of construction projects completed during the fiscal year Sept. 1, 1931 to August 31, 1932, by types, showing mileage and cost:

Type of Highway	Mileage Original	Mileage Stage	Mileage Total	Cost
Grading and Small Structures	1,095.07	.....	1,095.07	$7,037,837
Gravel Surface	.....	18.57	18.57	101,295
Caliche or Disintegrated Limestone	17.74	51.24	68.98	317,046
Macadam Surface (including Crushed Rock or Stone)	.....	36.25	36.25	310,510
Single Bituminous Treatment on Caliche or Disintegrated Limestone	.....	13.01	13.01	12,359
Double or Triple Bituminous Treatment on Caliche or Disintegrated Limestone	.....	94.98	94.98	841,118
Double or Triple Bituminous Treatment on Iron Ore Soil	.....	27.88	27.88	90,617
Double or Triple Bituminous Treatment on Gravel	12.86	89.08	101.94	918,137
Double or Triple Bituminous Treatment on Macadam	.....	46.51	46.51	433,535
Limestone Rock Asphalt on Macadam	.....	13.62	13.62	96,546
Limestone Rock Asphalt on Concrete	.....	7.31	7.31	143,482
Two Course Rock Asphalt on Gravel	2.74	4.55	7.29	108,464
Two Course Rock Asphalt on Macadam	.....	54.94	54.94	413,765
Two Course Rock Asphalt on Concrete	.....	11.90	11.90	223,471
Asphaltic Concrete on Macadam	.....	11.06	11.06	113,679
Sheet Asphalt Pavement on Concrete	.....	4.28	4.28	116,461
Concrete Pavement, Plain	.....	1.32	1.32	20,522
Concrete Pavement, Reinforced	124.41	565.29	689.70	13,377,697
Brick on Macadam with Concrete Shoulders	.53	.....	.53	16,970
Total—Roadway	1,253.35*	1,051.79†	2,305.14	$24,693,519

BRIDGES AND STRUCTURES

Bridges—	
Concrete	$ 103,437.75
Concrete and Timber	70,323.26
Concrete and Steel	2,439,623.88
Timber, Treated	73,786.33
Steel, Concrete and Timber	106,388.97
Underpasses—Concrete and Steel	186,914.45
Overpasses—Concrete and Steel	294,760.53
Total Bridges and Structures	$3,875,235.17
Grand total	$28,568,754.78

	Per cent	
Federal Funds	28.38	$ 8,106,516.51
State Funds	41.15	11,755,330.08
County Funds	29.95	8,557,489.27
Other Funds	.52	149,418.92
Total	100.00	$28,568,754.78

*Denotes initial improvement on unimproved highways.
†Denotes additional improvement on highways where initial improvement has been completed.

The following is a summary statement of projects under construction as of Aug. 31, 1932, by types, showing mileage and cost:

Type of Highway	Mileage Original	Mileage Stage	Mileage Total	Cost
Grading and Small Structures	892.92	.....	892.92	$5,337,812
Gravel Surface	.....	45.97	45.97	189,411
Caliche or Disintegrated Limestone	54.00	115.98	169.98	853,357
Macadam Surface (including Crushed Rock or Stone)	10.83	162.10	172.93	1,076,941
Iron Ore Soil Surface	.....	11.57	11.57	59,862
Single Bituminous Treatment on Caliche or Disintegrated Limestone	29.48	13.82	43.30	365,510
Single Bituminous Treatment on Iron Ore Soil	.....	9.27	9.27	34,006
Single Bituminous Treatment on Gravel	.....	24.75	24.75	220,390
Double or Triple Bituminous Treatment on Caliche or Disintegrated Limestone	46.96	136.34	183.30	1,097,494
Double or Triple Bituminous Treatment on Iron Ore Soil	.....	22.95	22.95	175,106
Double or Triple Bituminous Treatment on Gravel	.....	61.69	61.69	372,934
Double or Triple Bituminous Treatment on Macadam	.....	75.35	75.35	658,201
Two Course Rock Asphalt on Gravel	.....	9.18	9.18	66,166
Two Course Rock Asphalt on Macadam	.....	16.17	16.17	31,839
Asphalt Macadam on Macadam	.....	8.12	8.12	40,327
Concrete pavement — Reinforced	36.49	504.55	541.04	9,222,515
Total Roadway	1,069.78*	1,217.81†	2,287.59	$19,801,878

BRIDGES AND STRUCTURES

Bridges—	
Concrete	$ 166,455
Concrete and Timber	108,183
Concrete and Steel	1,782,537
Steel, Concrete and Timber	393,287
Underpasses—Concrete and Steel	48,930
Overpasses—Concrete and Steel	100,464
Total Bridges and Structures	$ 2,599,857
Grand total	$22,401,736

*Denotes initial improvement on unimproved highways.
†Denotes additional improvement on highways where initial improvement has been completed.
Note: Cost based on estimated quantities at contract prices.

In addition to the above there has been let from Sept. 1 to Dec. 21, construction contracts amounting to approximately $12,737,000.

No predication as to probable expenditures for 1933 can be made at this time.

Gibbs Gilchrist, Austin, Tex., is state highway engineer.

Tennessee

Expenditure of state highway construction in 1932 was approximately $5,500,000. Some details of the work are given in the tabulations.

Tennessee state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	70.0	20	7 2/3	$18,000
Bituminous Concrete	0.3	20	7 1/6	22,500
Rock Asphalt on Concrete	38.0	20	8 1/6	22,500
Gravel	59.7	18	2	2,500
Mixed in Place	114.5	18	2	3,500
Graded and Drained	24.4	36	0	11,000

The uncomplete work carried over to 1933 included 313.7 miles gravel or stone road, 34.2 miles rock asphalt on concrete base, 87.4 miles plain concrete, and 92.4 miles graded and drained.

It is not possible at this time to give any details regarding the 1933 program as this is dependent on the action of legislature which convened this month.

T. C. McEwen, Nashville, Tenn., is state highway engineer.

Louisiana

The following tables show the mileage of improved roads, by types, accepted by the Louisiana Highway Commission from Jan. 1, 1932, to Dec. 4, 1932, and work under construction to be carried over to 1933:

Type	Miles	Cost
Hard Surface	837.8	$19,840,693
Gravel Surfacing	195.9	438,644
Grading and Gravel	421.9	1,865,632
Grading	283.7	1,930,489
Bridges and Grade Separations	4.3	2,038,233
Total	1,743.6	$26,113,693
CARRIED OVER TO 1933		
Hard Surface	482.5*	$ 9,655,290
Gravel Surfacing	77.1	126,431
Grading and Gravel	112.7	759,214
Grading	203.9	1,792,685
Bridges and Grade Separations	11.9	6,285,241
Total	888.1	$18,618,863

*296 miles of the 482.5 miles of hard surfacing shown in the above tabulation of work under construction and to be carried over to 1933 has been laid but had not been accepted as of Dec. 4, 1932.

In the above tabulation of work completed is included four major bridge projects, viz., the bridge over Red River at Coushatta, bridge over the Ouachita River at Sterlington, bridge over Industrial Canal at New Orleans, and bridge over Mermentau River at Lake Arthur, at a cost of approximately $1,158,000.

It is not possible at the present time to give a complete statement of the road program for the year 1933, as any extensive construction program will depend upon the sale of the remainder of the authorized highway bond issue, the sale of which will depend upon the bond market.

The program for 1933, predicated on available funds, will consist principally of the completion of the work in progress, the construction of a relocation of the Old Spanish Trail between Rigolets and Pearlington; also the construction of some of the most urgently needed bridges, grade separations and sections of farmers' roads. The major objective will be the relocation of the Old Spanish Trail between Rigolets and Pearlington. The work will consist of the construction of nine miles of heavy marsh work and the construction of six large bridges, including the interstate bridge over East Pearl River at Pearlington. This work will cost approximately $1,300,000, and when completed will shorten the distance between New Orleans and Bay St. Louis approximately twenty miles.

Mississippi

The following work on the state highway system was completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	48	20	9–6–9	$20,000
Gravel (light)	103	20	1 to 6	600
Bituminous-Road Mix (oil treated gravel)	5	20	approx. 2	1,800
Graded and Drained	28	30	0	10,000
Surface treated gravel	34	20	¾ to 1	2,700
Total	218			

Number bridges over 20 ft. clear span, 19.

Uncompleted work carried over to 1933:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	87	20	9-6-9	20,000
Graded and Drained	106	30	0	10,000
Bituminous Concrete (1½ in. Sheet Asphalt or Asphaltic Concrete Wearing Surface; 3 in. Asphaltic Concrete, 8 in. Compacted Gravel)	28	20	0	18,000
Surface treated gravel	3	20	0	2,700
*Mixed in Place	2	24	0	.....
Road Mixed Treatment	2	20	0	1,800
Total	228			

Number bridges over 20 ft. clear span, 58.
*Experimental.

No program has been outlined at the present time for new construction for 1933 other than completing 1932 Emergency Construction Program. (U. S. Emergency funds matched with Federal Aid Funds.)

Mountain States

Idaho

The state highway work completed in 1932 included 440 miles of bituminous road mix, 409 miles of gravel road, 18 miles of bituminous plant mix and 136 miles of graded and drained road. Some details of the work follow.

Idaho state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
Gravel	409	18–20	6	$2,900
Bituminous—Road Mix	440	19	2½	†1,650
Bituminous—Plant Mix	18	18	2½	*5,400
Graded and Drained	136	26	0	6,350

*Includes aggregates.
†Does not include aggregates.

The uncompleted work carried over to 1933 included 5 bridges, 16 miles bituminous plant mix, 197 miles crushed gravel or rock and 145 miles of graded and drained road. The amount of the uncompleted work is $2,074,435.

Probable expenditures for construction in 1933 is uncertain at the present date as it is dependent upon Federal Aid appropriation and gas tax receipts.

J. H. Stemmer, Boise, Idaho, is director of highways.

Montana

State highway placed under contract in 1932 included 159 miles of bituminous road mix, 156 miles of bituminous plant mix, 632 miles of gravel road, and 531 miles of graded and drained road. Some details of this work follow.

Montana state highway contracted in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
Gravel	632	19	8*	$ 2,500
Bituminous—Road Mix	159	19	0	2,060
Bituminous—Plant Mix	156	19	0	5,350
Graded and Drained	531	..	0	5,900

*Loose.

Approximately $3,500,000 worth of work will be carried over into 1933.

It is impossible at this time to give any definite estimate for 1933, inasmuch as the program depends almost entirely upon the sale of $1,500,000 worth of gasoline tax anticipation debentures, and also upon the action

taken by Congress in appropriating Federal Aid funds.

R. D. Rader, Helena, Mont., is state highway engineer.

New Mexico

State highway placed under contract in 1932 included 186.9 miles of oil processed road, 12.6 miles of rock asphalt, and 166 miles of gravel base. Details of which are given in the tabulation.

New Mexico state highway contracted in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness Inch	Total Cost Per Mile
P. C. Concrete	11.06	20	6	$287,822
Rock Asphalt	12.66	20	½, ¾ & 1	126,978*
Gravel Base (including grading, etc.)	166.20	22	6	1,871,870
Oil—Processed	186.90	20	2½	798.359
Graded and Drained	28.92	26†	0	352,678

†Roadway. *Includes grading and structures and base on one project.

The uncompleted work carried over to 1933 (included in the above table) was as follows:

Types	Miles	Average Width Surfaced Ft.	Thickness Inch	Total Cost Per Mile
Graded, Drained and Gravel Base	148.87	22	6	$1,654,281
Oil—Processed	106.36	20	2½	451,614
Cement Concrete	8.61	20	6	217,146
Graded and Drained	28.92	26	0	352.678

The proposed new construction for 1933, the balance of the 1932-33 emergency program to be completed before July 1, 1933, includes the following:

Types	Miles	Probable Expenditure
P. C. Concrete	6.6	$148,000
Underpass and Approaches	0.25	107,300
Base Gravel (Incl. Grading and Structures	77.6	937,100
Oil—Processed	20.0	140,000

W. C. Eccles, Santa Fe, N. Mex., is state highway engineer.

Utah

The approximate expenditures in 1932 for state highway construction amounted to $3,115,000. The above includes total cost of projects placed under construction not completed, but does not include uncompleted projects carried over from 1931. In addition an expenditure of $1,600,000 was made for regular maintenance and special maintenance.

The work of 1932 is summarized as follows:

	Miles	Cost
Bridges (contracted separate from roadway)	...	$280,000
Concrete Pavement	15.9	421,000
Sheet Asphalt Resurface	2.4	30,000
Rock Asphalt on Crushed Rock Base	2.9	29,000
Rock Asphalt Shoulders	9.0	28,000
Dust Oil Treatment Gravel Roads	58.6	8,000
Oil Mix Gravel Surface Treatment	240.2	546,000
Regravel Preparatory to Oil Treatment	138.3	299,000
Gravel Surfaced Roads	173.7	1,474,000
Totals	641.0	$3,115,000

The state highway construction program for 1933 follows:

Total Estimated Funds Available for 1933	$3,200,000
Estimated Expenditures for Construct'n & Reconst'n	2,000,000
Maintenance	1,200,000
Estimated County Funds (Expended by Counties)	1,000,000

Further expenditures for construction dependent on additional federal appropriations.

State work budgeted for 1933:

Types	Miles	Estimated cost
Paved Roads	7.3	$220,000
Gravel or Crushed Rock	67.5	115,000
Grading and Graveling	7.3	150,000
Bridges		220,000

Remaining funds for construction have not been budgeted on account of delayed action of Congress regarding further federal aid appropriations.

H. S. Kerr, Salt Lake City, Utah, is chief engineer, state highway department.

Wyoming

State highway construction in 1932 involved an expenditure of $3,960,000. The state highway completed included 446 miles of 20 ft. wide, 6 in. thick, gravel roads at an average cost of $7,000 to $9,000 per mile. 500 miles of bituminous road 20 ft. wide, 2½ ins. thick at a cost of $1,800 for oil only, and 446 miles of 20 ft. graded and drained road.

Z. E. Sevison, Cheyenne, Wyo., is superintendent state highway department.

Pacific States

California

The total expenditure for state highway construction in 1932 was $24,500,000. In addition the uncompleted work carried over to 1933 requires a balance of $9,300,000 to complete these projects. Details of 1932 are given in the accompanying tabulation:

California state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness. Inch	Estimated Av. Cost Per Mile
P. C. Concrete	153.7	20–40	9–7–9	$37,208
Bituminous Concrete	72.2	20–40	3–6	28,829
Untreated Cr. Gravel or or Stone	56.0	20	6–8	15,942
Bituminous and Oil Treated Road Mix; Bituminous and Oil Treated Plant Mix	233.5	20	6	16,682
Graded and Drained	53.4	..	0	40,885

The uncompleted work carried over to 1933 included 58 miles of grading, 126 miles of oil treated or bituminous treated surface, 39 miles of asphalt concrete pavement, and 145 miles of portland cement concrete pavement.

The proposed new construction for 1933 to June 30, 1933, includes the following:

Types	Miles	Probable Expenditure
P. C. Concrete, Bituminous Concrete, Bituminous Macadam	59.0	$5,600,000
Plain Macadam, Crushed Gravel or stone, Bituminous—Road Mix, Bituminous—Plant Mix, Mixed in Place	25.0	
Graded and Drained	14.0	

The above is the work remaining in the present budget which will be placed under way during the first six months of 1933. The budget for the biennial period July 1, 1933, to June 30, 1935, is now being prepared for submission to the Legislature when it convenes in January. Until such time as this budget is approved by the Legislature, it is impossible to give a complete forecast for 1933.

C. H. Purcell, Sacramento, Calif., is state highway engineer.

Oregon

The expenditure for state highway construction in 1932 amounted to $5,530,000. The work completed included 173 miles of bituminous macadam, 125 miles of plain macadam, and 84 miles of oil surface treatment. The tabulation gives same details of the work.

Oregon state highway completed in 1932:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	7.60	20	7	$25.000
Bituminous Concrete	7.01	20	2 to 5	15,000
Bituminous Macadam	172.99	20	2	3,700
Plain Macadam	125.40	20	9	5,500
Gravel	48.70	20	5	900
Graded and Drained	236.50	32	0	10,000
Oil Surface Treatment	84.40	18	⅝	2,000

The uncompleted work carried over to 1933 is as follows:

Types	Miles	Average Width Surfaced Ft.	Thickness, Inch	Estimated Av. Cost Per Mile
P. C. Concrete	15.73	20	7	$25,000
Bituminous Macadam	24.84	20	2½	3,700
Plain Macadam	41.17	20	9	5,500
Gravel	32.20	12	4	900
Graded and Drained	95.51	32	0	15,000

It is not possible at this time to give the proposed new construction for 1933 as all plans are contingent upon the action of the legislature with regard to the revenue.

R. H. Baldock, Salem, Ore., is state highway engineer.

ESTIMATED COUNTY ROAD AND BRIDGE EXPENDITURES FOR 1933

State and County	Construction	Maintenance
ALABAMA:		
Dale	$20,000	$35,000
Jefferson	.....	.....
Limestone	40,000	60,000
ARIZONA:		
Cochise	20,000	80,000
Greenlee	.....	24,000
CALIFORNIA:		
Kings	30,000	18,000
Lassen	18,000	1,500
Monterey	70,000	100,000
Orange	180,000	478,000
Riverside	.....	200,000
San Joaquin	.....	400,000
Solano	20,000	118,346
COLORADO:		
Chaffee	.....	.....
Costilla	30,000	10,000
Elbert	31,994	10,000
Lake	79,000	15,000
La Plata	60,000	20,000
Pueblo	.....	.....
FLORIDA:		
Lee	10,000	25,000
Santa Rosa	40,000	15,000
GEORGIA:		
Clarke	50,000	4,000
Tift	40,000	5,000
Twin Falls Hwy. Dist.	8,000	32,000
ILLINOIS:		
Adams	40,000	10,000
Carroll	30,000	3,500
Cook	2,100,000	550,000
Douglas	.....	10,000
Edgar	.....	13,000
Iroquois	100,000	35,000
Jefferson	30,000	15,000
Kane	50,000	30,000
Lake	300,000	60,000
Macoupin	25,000	12,000
Marion	30,000	17,000
Mason	50,000	35,000
McDonough	25,000	18,000
McHenry	49,000	30,000
Menard	24,000	8,000
Monroe	12,000	36,000
Morgan	10,000	35,000
Piatt	.....	20,000
Pulaski	10,000	30,000
Richland	2,000	.....
St. Clair	2,000	.....
Shelby	25,000	1,500
Stephenson	40,000	35,000
Vermilion	.....	.....
Wayne	20,000	5,000
White	.....	.....
Will	20,000	65,000
Woodford	52,000	10,000
INDIANA:		
Boone	.....	110,000
Morison	.....	161,000
Wells	10,000	103,000
White	60,000	40,000
IOWA:		
Adair	42,000	65,000
Adams	40,000	50,000
Benton	50,000	105,000
Bremer	37,000	75,000
Buena Vista	4,000	70,000
Butler	40,000	50,000
Cass	.....	100,000
Clarke	40,000	40,000
Clinton	70,000	120,000
Davis	45,000	60,000
Decatur	30,000	70,000
Dickinson	20,000	25,000
Emmet	30,000	65,000
Fayette	66,000	80,000
Fremont	40,000	75,000
Grundy	30,000	75,000
Hamilton	60,000	100,000
Hancock	40,000	70,000
Hardin	36,000	95,250
Harrison	30,000	175,000
Howard	53,000	65,000
Iowa	110,000	90,000
Johnson	223,000	120,000
Jones	30,000	120,000
Kassuth	72,000	107,000
Lee	85,000	85,000
Linn	50,000	126,000
Louisa	42,000	57,000
Lucas	15,000	40,000
Mahaska	75,000	20,000
Marion	80,000	80,000
Mitchell	60,000	67,000
Monona	70,000	100,000
Muscatine	70,000	65,000
Page	30,000	90,000
Palo Alto	50,000	80,000
Pocahontas	10,000	100,000
Scott	93,496	67,495
Shelby	42,000	115,000
Sioux	45,000	74,000
Tama	10,300	130,600
Union	15,000	70,000
Warren	100,000	90,000
Wayne	50,000	77,000
Webster	85,915	55,113
Winnebago	40,000	60,000
Wright	80,000	90,000
KANSAS:		
Brown	25,000	25,000
Butler	20,000	20,000
Cherokee	30,000	60,000
Clay	40,000	17,000
Cowley	35,000	20,000
Ellis	20,000	10,000
Finney	30,000	20,000
Harvey	43,491	32,835
Jackson	22,000	14,000
Jefferson	50,000	350,000
Kingman	5,000	20,000
Labette	110,000	90,000
Leavenworth	5,000	22,000
Linn	.....	35,000
Lyon	30,000	32,000
Miami	45,000	54,000
Neosho	20,000	25,000
Norton	15,000	15,000
Osage	35,000	50,000
Rice	10,000	15,000
Riley	40,000	25,000
Rooks	4,000	9,000
Sumner	30,000	40,000
Thomas	8,000	7,000
Wichita	12,000	6,000
Wilson	-5,000	18,000
KENTUCKY:		
Kenton	150 000	150,000
Leitchfield	3,000	14,000
Logan	15,000	10,000
Mercer	30,000	.....
Nelson	18,000	12,000
LOUISIANA:		
Caddo	20,000	80,000
Madison Parish	.....	10,000
MASSACHUSETTS:		
Essex	.....	80,000
Norfolk	5,000	5,000
Plymouth	.....	.....
MICHIGAN:		
Alger	35,000	14,000
Cass	.....	76,000
Chippewa	46,000	92 000
Emmet	12,000	65,000
Genesee	425,000	300,000
Grand Traverse	40,000	57,000
Houghton	.....	120,000
Huron	25,000	110,000
Ionia	.....	75,000
Iosco	.....	50,000
Kent	250,000	250,000
Keweenaw	100,000	30,000
Luce	15,000	34,000
Macomb	20 000	70,000
Marquette	390,000	50,000
Menominee	.....	50,000
Monroe	.....	110,000
Presque Isle	15,000	27,000
Muskegon	.....	.....

State and County	Construction	Maintenance
Van Buren	.....	160,000
MINNESOTA:		
Aitkin	35,000	25,000
Becker	40,000	30,000
Benton	20,000	12,000
Blue Earth	30,000	55,000
Carlton	10,000	35,000
Cass	30,000	50,000
Chisago	30,000	40,000
Dakota	15,000	40,000
Dodge	40,000	30,000
Fillmore	65,000	50,000
Grant	25,000	4,000
Hennepin	118,000	250,000
Koochiching	.....	60,000
Lincoln	35,000	25,000
Marshall	100,000	25,000
Olmsted	30,000	107,000
Otter Tail	20,000	110,000
Red Lake	25,000	18,000
Rock	38,000	28,000
Scott	50,000	40,000
Sibley	50,000	60,000
Stevens	30,000	20,000
Swift	.....	30,000
Washington	25,000	25,000
Watonwan	10,000	35,000
Winona	94,000	85,000
Wright	50,000	33,000
MISSISSIPPI:		
Webster	.....	180,000
MISSOURI:		
Chonton	20,000	.....
Dallas	1,400	.....
Livingston	10,000	.....
Newton	16,000	44,000
Ste. Genevieve	.....	.....
Warren	18,000	10,500
MONTANA:		
Beaverhead	.....	35 to 40,000
Gallatin	46,000	56,000
Petroleum	6,500	6,500
Pondera	19,360	4,640
Sheridan	.....	14,000
Toole	15,000	15,000
NEBRASKA:		
Clay	20,000	12,500
Fillmore	3,000	7,000
Hayes	8,000	.....
Richardson	60,000	60,000
Saunders	25,000	40,000
Webster	25% less	10% less
NEVADA:		
White Pine	2,000	15,000
NEW JERSEY:		
Hunterdon	100,000	112,000
Salem	.....	234,000
Union	185,000	35,760
NEW YORK:		
Albany	100,000	150,000
Allegany	200,000	50,000
Cayuga	138,000	90,000
Chautauqua	300,000	108,000
Dutchess	202,000	65,000
Franklin	211,739	37,500
Herkimer	200,000	115,000
Madison	65,000	85,000
Niagara	50,000	250,000
Orange	300,000	12,000
Orleans	.....	10,000
Saratoga	165,000	100,000
Schenectady	400,000	35,000
Suffolk	291,000	50,000
Tompkins	200,000	50,000
Ulster	.....	.....
NORTH DAKOTA:		
Sheridan	.....	4,000
Williams	.....	.....
OHIO:		
Ashland	44,000	64,400
Butler	85,000	24,000
Carroll	70,000	20,000
Clinton	100,000	10,000
Cuyahoga	700,000	650,000
Defiance	10,000	60,000
Fayette	.....	60,000
Fulton	20,000	10,000
Hardin	30,000	60,000
Harrison	45,000	45,000
Henry	15,000	60,000
Hocking	20,000	80,000
Logan	.....	85,000
Lorain	50,000	125,000
Mercer	10,000	22,500
Paulding	15,000	115,000
Pike	45,000	45,000
Summit	100,000	225,000
Van Werf	60,000	14,000
Vinton	60,000	15,000
Warren	107,000	30,000
OKLAHOMA:		
Alfalfa	25,000	20,000
Blaine	31,175	32,125
Cherokee	.....	.....
Garfield	25,000	50,000
Grady	28,000	70,000
Oklahoma	90,000	38,000
Payne	.....	90,000
Tillman	.....	82,768
OREGON:		
Clatsop	.....	130,000
Douglas	100,000	20,000
Lane	80,000	190,000
Lincoln	25,000	18,000
Morrow	25,000	15,000
Multnomah	1,345,000	565,000
Polk	.....	70,000
Union	44,000	25,000
PENNSYLVANIA:		
Tioga	.....	.....
Westmoreland	.....	5,000
SOUTH CAROLINA:		
Charleston	25,000	85,000
York	25,000	85,000
SOUTH DAKOTA:		
Douglas	10,000	6,000
Gregory	7,000	12,000
Hamlin	5,000	13,000
Hanson	30,000	10,000
Harding	.....	8,000
Hutchinson	35,000	10,000
Jerauld	.....	15,000
Jones	5,000	.....
Laurence	50,000	25,000
McCook	20,000	7,500
Meade	20,000	8,000
Perkins	15,000	20,000
Stanley	1,000	2,000
Turner	64,000	.....
Yankton	20,000	15,000
TENNESSEE:		
Dyer	1,000	15,000
Haywood	15,000	20,000
Obian	.....	75,000
Shelby	81,900	244,600
Warren	30,000	6,000
TEXAS:		
Brazoria	780,000	63,000
Brown	100,000	24,000
Camp	.....	20,000
Carmeron	160,000	150,000
Childress	130,000	10,000
Guadalupe	230,000	50,000
Madison	5,000	20,000
Mills	250,000	.....
UTAH:		
Garfield	2,500	1,000
Sevier	120,000	15,000
Summit	25,000	15,000
Utah	75,000	.....
VIRGINIA:		
Bedford	100,000	.....
Dickinson	.....	50,000
WASHINGTON:		
Asotin	38,000	25,000
Columbia	68,000	28,000
Garfield	.....	.....
Grant	32,000	13,000
Grays Harbor	122,000	233,221
Island	50,000	30,000
Lewis	100,000	75,000
Okanogan	75,000	25,000

(*Continued on page 23.*)

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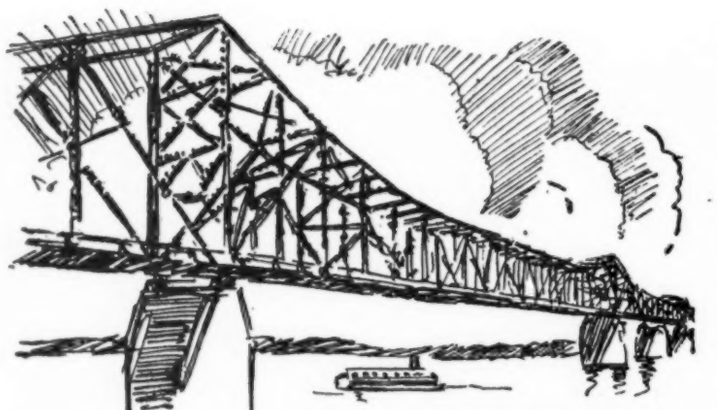
DETROIT, MICH.

WHY—*Many Toll Bridges Should Be Built*—NOW

By H. P. GILLETTE
Editor-in-Chief.

THE Reconstruction Finance Corporation is empowered to lend money to states, counties, townships, cities and villages for the construction of public works that will be "self-liquidating." Toll bridges are "self-liquidating," and should be built now wherever there is an economic need for them. We say "now" for three reasons: First, because the building of bridges will give employment; second, because materials and wages are low and labor efficiency is high; and, third, because federal money can be secured at low rates of interest.


EVERY DAY THE BONDS ON THE LOUISVILLE MUNICIPAL BRIDGE ARE GROWING STRONGER BECAUSE $951,000 IN BONDS HAVE BEEN RETIRED IN LESS THAN THREE YEARS WITHOUT COSTING THE TAXPAYERS ONE CENT, ACCORDING TO SPECIALISTS IN THESE BONDS!
"From the Louisville Courier Journal"

Harriman in the railway field and Rockefeller in the oil field expanded their holdings and increased both their rehabilitation and new construction activities during the great depression that started in 1893. The result was an enormous increase in their wealth soon after the end of that depression. Their credit was good and they exercised it to the limit, believing that the best time to expand and improve plants is when prices are low. Certainly the economic principle thus applied by such successful business men can be profitably adopted by public officials. Now, if ever, is the time to adopt the principle of making extensive additions and improvements to the highway transportation plant, of which bridges constitute an important part.

In the August issue of ROADS AND STREETS the leading article is entitled "Did President Hoover Get His Idea from Kentucky?" That article describes how the Kentucky Highway Commissioners were authorized, by a law enacted in 1928, not only to buy existing toll bridges but to build new ones, through the issuance of bonds. Upon the retirement of the bonds from toll revenue, these bridges become free. In the latter part of 1930 this highway commission let the first contracts for new toll bridges, 10 of which have been contracted for at a total cost of nearly $5,000,000.

It has been suggested that it was this Kentucky innovation that gave to President Hoover the germ of the idea that resulted in the Reconstruction Finance Corporation which is empowered to lend one and a half billion dollars for "self-liquidating" projects.

Since Kentucky found an immediate need of 10 new toll bridges, it is probable that traffic surveys in other states will disclose similar needs. If so, several hundred toll bridges will be built, provided that every state and municipality exercises its right of borrowing the money from the Federal Finance Corporation.

We urge state, county and city engineers to make traffic surveys as soon as possible, with a view to showing public officials and the editors of daily papers what toll-bridge projects should be undertaken. Abutments, piers and approaches usually cost about as much as superstructures of large bridges. This work calls for labor and materials that are almost entirely local. The erection of the superstructure falls in the same category, leaving only the steel to be imported from a distance. In manufacturing and fabricating the steel, labor in some sister state will usually be employed, but the employment of any man anywhere in America will play its part in lifting all Americans out of this "slough of despond." It is a false policy to restrict public works projects to those in which only local labor is employed. Not until employment shall have been increased substantially throughout America will business revive sufficiently to insure a speedy end of the depression. As the cause of the depression is not local, so its cure will not be local. Let us adopt the slogan of "the three musketeers": "One for all, and all for one."

▼

WAYNE COUNTY, MICHIGAN, TAKES OVER TOWNSHIP ROADS.—During 1932 Wayne County, Michigan, took over 156 miles of township roads, and it is expected that within the next four years all the township roads will be absorbed into the county road system.

CUT-BACK ASPHALTS— *Their Characteristics and Use*

By PREVOST HUBBARD
Chemical Engineer, The Asphalt Institute

Part I—Characteristics

(Concluded in February issue.)

PETROLEUM refining is primarily a process of distillation by means of which various constituents of the crude oil are separated from each other. Two general classes of products are produced by this process—distillates and residuals. Distillates are the lighter and more volatile constituents which are vaporized, and recovered by condensation in a coil or cooling chamber. Residuals are products which do not distill over during the process but are left behind in the distilling apparatus. If a relatively small quantity of distillate is removed the resulting residual is quite liquid. As more distillate is removed the residual becomes more viscous until eventually an asphalt cement remains in the distilling apparatus.

In the broadest sense, cut-backs are manufactured products, composed of residuals which have been fluxed or blended with distillates of similar origin. Cut-back asphalts are therefore asphalt cements fluxed to any desired viscosity with distillates produced in refining petroleum. They thus differ from the ordinary fluxed asphalt which is an asphalt fluxed or blended with a liquid residual oil. Sometimes liquid residual oils are combined with distillates in order to reduce the viscosity of the former. While such products are cut-backs, they are not cut-back asphalts for the reason that the base which was fluxed with the distillate is not an asphalt cement. In addition to the three classes of fluxed products already mentioned, there is a fourth which may be termed blended oils. These are mixtures of two or more liquid residuals.

In order that there may be no misconception regarding these four classes of products, they may be summarized as follows:

1. Cut-back asphalt = asphalt cement + petroleum distillate.
2. Cut-back residual oil = residual oil + petroleum distillate.
3. Fluxed asphalt = asphalt + residual oil (flux).
4. Blended oil = residual oil + residual oil.

It is the first class only which will be discussed in this paper.

No other type of asphalt product has increased in production and use during the past few years as rapidly as has cut-back asphalt. During 1929, about 130,000 tons of cut-back asphalt was used in the United States mainly for highway purposes. In 1930, the quantity increased to nearly 262,000 tons or over 100 per cent and in 1931, the total amounted to over 446,000 tons, 70 per cent more than for 1930 and nearly 3½ times as much as for 1929. The present year will undoubtedly show a further material increase.

General Characteristics of Cut-Back Asphalts.—The function of the distillate in a cut-back asphalt should be to temporarily liquefy the asphalt cement so as to facilitate its application and manipulation in highway treatment and construction. It is thus a substitute for heat which could be used to render the asphalt liquid prior to use. For certain types of work, however, it is more useful than heat because its liquefying effect extends over a longer period of time. Eventually, however, it should separate from the mixture leaving an asphalt cement in place as a bonding and waterproofing medium. The distillate should therefore be of a type which will be volatilized or otherwise removed after it has served the purpose for which it was used. Heavy non-volatile distillates can be employed in the preparation of cut-back asphalts to render the asphalt liquid, but such products resemble liquid residuals in their non-hardening or extremely slow hardening characteristics. Relatively light volatile distillates are therefore used in the manufacture of cut-back asphalts.

The degree of fluidity of a cut-back asphalt is largely a function of the amount of distillate used in its preparation. The more distillate present the more liquid

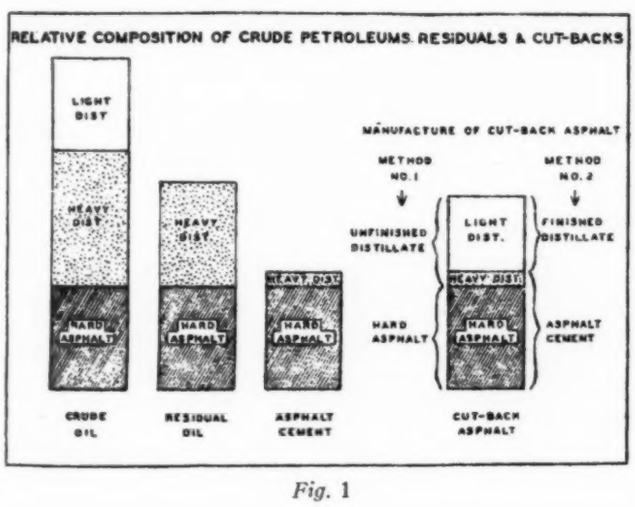


Fig. 1

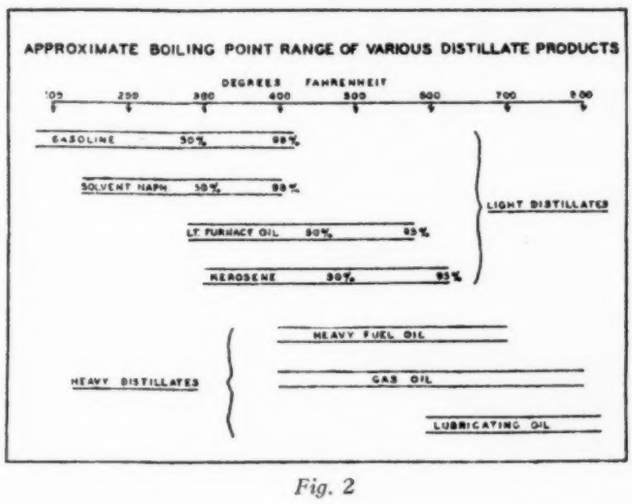


Fig. 2

becomes the final product. With a large amount of any light distillate an asphalt cement may be fluxed to almost water thin consistency. With lesser amounts more viscous products are obtained of any desired consistency. In general, the harder the original asphalt cement, or the lower its penetration, the greater will be the quantity of a given distillate required to bring it to a given degree of fluidity. However, a marked difference is often found in the liquefying capacity of a given distillate for asphalts, of the same penetration obtained from different sources or produced by different processes, so that the amount of distillate present cannot be two intimately associated with the viscosity of the finished product. Failure to recognize this fact has, in some cases, been responsible for the development of specifications in which the relations between viscosity requirements, percentage of distillate recovery by test, and penetration of the recovered asphalt, have been so close as to eliminate products which would be satisfactory for the intended use.

There is another factor connected with the liquefying capacity of distillates for asphalt cements that should be noted, namely, that the heavier or less volatile the distillate the more of it will be required to bring an asphalt cement of given penetration to a given degree of fluidity. The most desirable range in fluidity which cut-backs should possess depend upon factors which will be discussed under the uses to which these materials are put. This characteristic is determined by means of a viscosity test with the Furol Viscosimeter, the temperature of test usually being 77° F., 122° F., or 140° F., depending upon whether the product is very liquid or very viscous.

The hardening characteristics of cut-back asphalts or the rapidity with which they may be expected to revert to an asphalt cement, after application or use, depends upon the amount and character of the distillate which is present and upon conditions attending their use. The more volatile the distillate the more rapid will be the rate of hardening, other conditions being the same. However, the rate of hardening is also governed by the amount of distillate present, those containing a large amount of distillate hardening more slowly than those containing a smaller amount. Thus, when made from the same constituents the more fluid products, under normal atmospheric conditions, require a longer time to revert to an asphalt cement than do the more viscous products.

Manufacture of Cut-Back Asphalts.—In the refining of petroleum, it has already been pointed out that two classes of products are formed, distillates and residuals. In the initial process the distillate fraction is separated into a number of grades, according to their respective boiling point ranges. These fractions are then further refined, frequently by redistillation and chemical treatment, to produce finished distillate products, such as gasoline, kerosene, various grades of furnace oil, heavy distillate fuel oil, gas oils and lubricants. In the original distillation of the crude petroleum, sharp divisions between the fractions insofar as their boiling points are concerned, cannot be made. The reason for this is that the entire distillate is made up of a great number of individual hydro-carbons with a gradation in boiling points running from the lowest to the highest temperature of distillation, and a certain amount of heavy distillate is carried with the lower boiling hydro-carbons.

Redistillation and chemical treatment adds considerably to the expense of finished products and in the manufacture of cut-backs, it is often more economical for the refiner to use unfinished distillates than those which have been manufactured to an exact and narrow range of boiling points. Even the carefully manufactured finished products usually contain traces of heavier distillates. Provided the presence of these heavy distillates is recognized and properly cared for by the selection of an asphalt of suitable penetration, a cut-back, produced with an unfinished distillate, is just as satisfactory and less costly than one produced with a finished distillate.

Asphalt cement may be considered as a combination of very hard asphalt with heavy distillate. The more distillate present the softer will be the asphalt cement. If a soft asphalt cement is subjected to distillation and a portion of this distillate removed, the asphalt cement becomes harder. These heavy distillates do not volatilize at normal temperature. It is evident, therefore, that two cut-back asphalts of the same general characteristics may be produced, one from a relatively soft asphalt with a finished light distillate containing no heavy ends, and the other from a harder asphalt with a light unfinished distillate containing a small percentage of heavy ends. In the first case practically the entire distillate may be expected to volatilize, leaving the original asphalt cement, while in the second case, all but the heavy ends of the distillate may be expected to volatilize leaving the original hard asphalt permanently softened to the same consistency as the base used in the first instance. This example is graphically illustrated in the right hand diagram of Fig. 1, which also shows the relationships which have been developed between crude oil, residual oil, asphalt cement and cut-back asphalt. From the above, it is evident that specifications for cut-backs should not attempt to cover the characteristics of the original constituents as such requirements may restrict the producer, raise costs and tend to eliminate desirable competition, without in any way bettering the product.

There is considerable overlapping in the boiling point ranges in the constituents present in the various grades of finished distillates as shown in Fig. 2. The first four grades are classed as light distillates and, in an unfinished state, are commonly used in the preparation of cut-back asphalts. Other grades, classed as heavy distillates, would not ordinarily be used for this purpose except as certain of their fractions might be present to a limited extent in the light products.

Value of Distillation Test for Cut-Backs.—The hardening characteristics of a cut-back asphalt are determined and specified by means of a distillation test, in which they are gradually heated to a maximum temperature of 680° F., after which the residue is removed from the distilling flask, allowed to cool and its penetration determined. It has been found that a temperature of 680° F. is necessary to remove by this method all but the last traces of a refined gasoline distillate which is known to evaporate from the product at normal air temperatures when the cut-back is distributed over a surface in a relatively thin film.

The test in general indicates, therefore, the character of base which may be expected to develop after use of the cut-back, *provided the distillate is afforded an opportunity to leave it.*

This characteristic is covered by specifying the desired penetration limits of residue obtained from the distillation test. From the foregoing discussion, however, it is evident that these limits need not apply to the penetration of the asphalt used in making the cut-back.

The rate of hardening of the product is indicated by the proportion of the total distillate removed which comes off at certain lower temperatures which have been selected as a basis of comparison, such as 437° F. and 600° F., and specifications for cut-back asphalts frequently contain requirements for minimum or maximum percentages which should be recovered when the material is distilled to these temperatures.

The balance of this article will appear in the February issue of Roads and Streets.

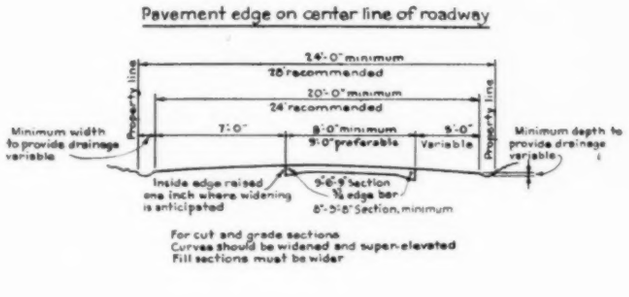
Engineering and Grading POLICIES *For Single Track Concrete Roads*

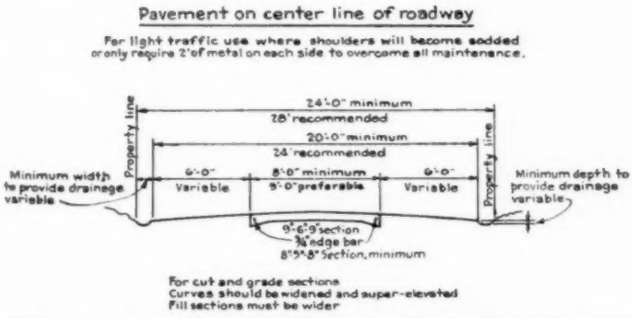
A STUDY of local improvement programs shows that communities can generally be placed in one of two general classifications. In one classification is found the communities that are improving their main traffic roads. As a result they are building considerable mileage of road which will later be on the state system and need widening. In the other general classification is found those communities which have their main traffic roads completed and are improving their purely local roads.

Each of these general groups presents different design and construction requirements to economically solve road improvement programs. An understanding of those standards which have given satisfaction will permit a community to determine the standards most economical for them.

Main Route Standards.—Single track concrete roads which will later become a part of state systems or a heavily traveled local road have similar requirements. It is desirable to place one edge of the pavement on the center line of the roadway. The inside edge should be raised 1 in. to provide drainage and crown. This permits widening at a later date by the addition of one more single lane of concrete. Culverts, bridges and all drainage structures can be widened on one side at a later date if need arises.

Horizontal curve requirements should conform as near as possible to state standards with the use of widening and super-elevation. Vertical curves should likewise follow state standards closely. The same is true of sight distances.





Minimum Design Recommendations for Single Track Concrete Roads. Widths of Pavement Shoulders, Ditches, etc., Will Be Dictated by Traffic Requirements.

In planning these original improvements it should be borne in mind that many temporary conservations of funds can be achieved by the use of old drainage structures. Advantage should be taken of every possibility to utilize these structures by planning and forethought. It may be advisable in some cases to leave short stretches for later paving in order to utilize the more expensive drainage structures. Later road improvements can bring these structures up to state standards.

It is advisable to follow state requirements for maximum grades. However, cuts of any depth should be carefully studied to determine their economical construction. It will often be found more economical to pave for a width of 18 ft. and place curb and gutter to give a roadway of 22 ft. than to pave for 9 ft. and construct the usual shoulders and ditches. The excavation involved in the additional cut for ditches will often more than pay for the paving.

It is essential to provide adequate drainage at all loca-

Gaps at County and Township Lines Need Not Be Entirely Eliminated through Purchase of Additional Right-of-Way. Existing Right-of-Way Width Will Usually Be Adequate.

tions on the improvement. State requirements should be carefully followed with the only exception being found in the utilization of old drainage structure.

A 9 in.-6 in.-9 in. cross-section should be used with longitudinal edge bar. The width which can be satisfactorily used varies from 8 to 10 ft. A minimum width of 9 ft. is preferred. The standard width on state projects should be used as a criterion and one-half this used for the single-track concrete road.

All features of construction should follow state practice very closely. This is particularly true of specifications dealing with fill and sub-grade preparation. Methods of proportioning, finishing and all items dealing

Shallow Ditches Will Handle Surface Water Efficiently.

Grade Lines Can Often Follow the Natural Terrain with Safety to Traffic.

with the quality of concrete should likewise be in accord with state specifications. Requirements for roadway width, ditches, ditch back slopes, etc., need not be fulfilled at the time of original construction provided provisions are made for fulfilling these requirements at a later date.

Local Route Standards.—The design and construction requirements for single track concrete roads in the second group of local road improvement require particular attention. They can be materially modified without decreasing the service value of the improvement. As previously stated, the second group of improvements include those areas already having their main roads well developed. It might be said that this classification of roads can be described as those which cannot be estimated to carry enough traffic to warrant widening at any time.

In this group the primary object is to give year around service over the greatest mileage possible. The major economies in design in this group can be effected in grading. The old grade line of the existing road should be utilized in so far as possible. Maximum grades of 10 per cent may be safely used. In addition, vertical curves of 200 ft. need not be exceeded. The only grading necessary on the old roadway can be accomplished in many cases by the grading equipment normally used for grading earth roads. The forms can be placed on the old roadway with a minimum of excavation and the shoulders built up later by pulling earth in from the ditches with graders.

Where over-flow may exist during floods, it is essential to rip-rap the down stream shoulder or construct the single track concrete road on the down stream side of the roadway and extend a concrete apron over the down stream shoulder to protect the shoulder from erosion during floods.

It will be found advantageous in general to locate the single track concrete road on the center line of the roadway. Minimum shoulder widths of 6 ft. on each side of the slab may be used. The best alignment possible without expenditures for grading should be used. The location of the slab need not be on tangent for any great distances or follow the right-of-way center line closely. Jogs which often occur at townships and county lines need not be straightened materially. Good curvature can be secured by placing the pavement close to the edge of the right-of-way on one side and swinging to the opposite side of the right-of-way at the other end of the reverse curve. There are many advantages to utilizing the old grade and roadway. Paving can proceed at once without waiting for new fills to settle. Shoulders will be sodded already and not subject to wash and thus save maintenance.

Another economy that can often be effected is by doing such shoulder work as may be necessary, after the pavement is constructed. This insures the moving of a minimum of earth. Also a more sightly job can be had with less experienced men. Once the slab exists, local forces can build up the shoulders to the desired width and grade and without the use of elaborate plans, profiles and specifications and the engineering expense incident to their preparation.

The utilization of drainage structures already in place present many possibilities for economy. These structures can often be used very effectively by slight shifting of the grade lines and alignment to give a first class job. Particular study should be given to the utilization of structures for the larger stream crossings. In the road building era of 1900 to 1910, many high grade bridges were installed. While these bridges may be narrower than required by present standards they are still fully adequate structurally.

Many localities also utilize old cross-road culverts, side road culverts and private entrance culverts to excellent advantage. These minor drainage structures can also be constructed very economically by the use of concrete pipe or tile or the encasing of concrete tile. The construction of side road and private entrance culverts after construction of the slab also permits economies to be effected.

The cross section may be 9 in.-6 in.-9 in. or 8 in.-5 in.-8 in. with edge bars. The width used may be 8, 9 or 10 ft. These widths will permit meeting vehicles to pass with one car entirely on the concrete and the other car with its two left hand wheels on the concrete. The 8-ft. width requires 11 per cent less material than the 9-ft. width and gives a proportionately longer mileage at the same cost.

Horizontal curves of a minimum radius of 200 ft. may be used in level country. Widening is also essential with proper super-elevation. Sight distances of at least 250 ft. should be provided for safety. Caution signs are erected where short curvature or sight distance prevails.

The expenditure of monies for additional right-of-way will not be warranted in most cases. It will be found by walking over the proposed improvement that even 28-ft. right-of-ways may be entirely adequate.

In regard to necessary cuts, full estimates should be made of the cost of an 18-ft. pavement with curb and

gutter and the cost of grading and ditching the wider roadway needed without gutters. The item of maintenance should also be fully considered as the roadway with curb and gutter will require very little maintenance while the maintenance of the other type roadway will be an item for at least two or three years. A further economical expedient to be fully considered is the use of a single track concrete road with gutter on one side and the construction of an independent gutter at pavement grade where the other ditch line would normally occur. Width of roadway may be reduced somewhat by this method with accompanying savings in grading costs.

All specifications regarding the production and quality of concrete should conform in all respects to state specifications. Special investigations of local materials will permit their use in many cases. However, no leeway should be given to durability requirements of local aggregates.

One of the outstanding advantages of the single track concrete road is the fact that it can carry full loads at any season of the year. For this reason, nothing should be permitted in the specifications which will jeopardize the quality of the concrete.

Local conditions will largely govern in the specific design requirements required by each locality. An understanding of the underlying principles involved in using single track concrete roads on both primary routes and clearly farmer feeder roads will dictate the best policies in each area.

The ideas of modern design requirements of main traffic routes have been stressed for many years. As a result the idea has become clouded and forgotten in many cases, that grading and alignment requirements should conform to traffic requirements. The grading and alignment requirements for single track paving on light traffic roads are the same as for the same road covered with gravel.

The economical viewpoint on the improvement of all roads in the light traffic group is the utilization of the present roadway and alignment. It might be said that engineering procedure should work from this point, making only such changes as are absolutely necessary. It will be found that a surprisingly few number of grade changes are necessary to give a project with higher engineering standards than recitation of minimum permissible design requirements would indicate.

The secret of successful use of single track concrete roads in the light traffic field is found in the use of grading and alignment requirements adequate for this class of road. The fact that it will be paved with one lane of concrete does not warrant the expediture of huge sums for grading and alignment changes. These requirements on light traffic roads are the same, regardless of the type of surface used for improvement. Experience shows that the single track can be fully utilized even years later for higher traffic volumes.

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Indiana Transfers Town Roads to Counties

All township roads in Indiana were on Sept. 1 transferred from the jurisdiction of the township trustees to the board of county commissioners. At the same time a moratorium on the issuance of county road bonds was declared. Another act diverts to the counties, cities and incorporated towns half of the net proceeds of the motor vehicle fees. The other half goes to the state highway department. Indiana has a four cent gas tax, three cents going to the state and one cent to local roads.

Open Letter to *Arthur Brisbane*

Mr. Arthur Brisbane,
238 William Street,
New York City, N. Y.

December 20, 1932.

Dear Mr. Brisbane:—

Your very interesting editorial discussion of the economic conflict between the railways and their highway competitors leads me to enclose an editorial article that I wrote for the October issue of ROADS AND STREETS. That article contains the first statistical reply to the contention of railway executives that the highway users are subsidized by the public.

You will see that gasoline "tolls" and license fees suffice to pay all the maintenance costs plus 5 per cent on the investment in rural roads.

You may be interested also in the fact that the highway plant represents an investment of 40 billion dollars, as compared with 27 billions in the corresponding railway plant.

The railways are making a great mistake in urging national and state legislators to hamstring their highway competitors by higher taxation and public regulation. It is drastic public regulation that has brought the railways to the verge of disaster.

You speak of the obsolete rolling stock of the railways. I enclose an article from another of our publications, *"Motive Power,"* which supports your criticism. It describes a new motor-driven railway coach that weighs only 22,000 lb. and carries 47 passengers.

Railway propaganda has not yet seriously retarded the improvement of our highways, but it is designed to do so. Far more hurtful has been the diversion of gasoline "tolls" to other than highway uses. Gasoline taxes are really "tolls" paid for the use of highways, and intended to provide funds for their maintenance and improvement. Thoughtless legislators have diverted many of those "tolls" to other uses, and have thus thrown out of employment scores of thousands of road maintainers and builders. The Illinois legislature, for example, has diverted gasoline "tolls" to relief of the unemployed, apparently not realizing that every dollar thus diverted adds to unemployment in the highway field.

Yours truly,

H. P. Gillette,
Editor, Roads and Streets.

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(*Continued from page* 17.)

ESTIMATED COUNTY ROAD AND BRIDGE EXPENDITURES FOR 1933

State and County	Construction	Maintenance
Spokane	89,000	.....
Whatcom	187,944	101,000
Whitman	150,000	230,000
WEST VIRGINIA:		
Harrison	.....	.....
Lewis	25,000	18,000
Monongalia	45,000	40,000
WISCONSIN:		
Adams	.....	30,000
Barron	.....	150,000
Dane	98,650	107,386
Dodge	.....	140,835
Green Lake	.....	45,000
Iowa	50,000	60,000
Ozankee	62,000	64,000
Richland	45,000	100,000

State Highway MAINTENANCE PRACTICE

Reports Indicate Trend of Methods Employed by Divisions Charged with Upkeep of the Roads

PRESERVING our street and highway investment is the first duty of public officials charged with street and highway supervision. A study of maintenance practice in state highway departments is the best way to fully appreciate the efficiency and dispatch with which they operate. Data from other states and counties than the ones given here are equally instructive but space prohibits their publication at this time. By courtesy of the American Road Builders' Association they may appear in later issues of ROADS AND STREETS.

Different topographical, administrative, and road conditions cause varying maintenance methods among the several states. The reports which follow are arranged in form in answer to definite questions that were sent to the various state highway departments.

MAINTENACE FOR MINNESOTA

(A) Clearing—Brushing—Weed and Grass Cutting

Work in Minnesota is being done quite largely with farm type mowers equipped with rubber tires. In a few cases special hitches and steering devices have been devised so that mowers can be successfully operated on embankments, slopes, deep ditches, and other irregular surfaces while being towed behind a truck. Over stony ground and stumpy areas, brush is being cut largely by hand, but right of way areas are being converted to a condition where ordinary equipment can handle the work. There is a possibility for the development of some type of mower that will handle the roadside cutting more advantageously. A few mowers consisting of a power take-off attachment to small farm type tractors are also being used.

In the cleaning of ditches, etc., present equipment on the market seems to be satisfactory. Small shovels, drag lines, elevating graders and blade graders, and in some cases team scrapers, are being used for this purpose. A few tractor scrapers have also been tried out with success.

In cleaning and thawing out culverts, no special problems seem to present themselves. Thawing is being done by small steam portable boilers mounted on skids. These boilers are placed on trucks and transported to points where needed, and dismounted when their need no longer exists.

(B) Earth Surface Types

The blade graders of various sizes and weights now on the market seem to be satisfactory for any work that needs to be done on road surfaces.

Trimming up shoulders does not seem to present any problems requiring special equipment, either for doing the shoulder work or disposing of the surface material.

For mixing earth surface materials, such as clay and gravel, oil and gravel, etc., there might be a need for some heavier type of machinery than is now available in agricultural equipment, such as discs, harrows, clod-breakers, etc. Equipment of this nature is being used in Minnesota, but is found to be somewhat unsatisfactory on account of its light design.

(C) Gravel Surface Types

Several devices have already been tried in Minnesota aimed at spreading gravel by some mechanical means, but it seems as though an experienced operator on a blade grader can accomplish this just as good, or better than special spreading machines and at much less cost.

Blade grader cutting edges have already been standardized among a group of states in the Mississippi Valley and the plan is working out excellently and has resulted in a substantial reduction in the cost of blade grader cutting edges.

No roadside portable crusher units are being used in Minnesota, since there is no need for such equipment.

Taken as a whole, there is very little oversize material being removed from Minnesota roadways, in view of the fact that before placing surfacing material all oversize has been removed either by screening or crushing at the pit. What limited amount of oversize shows up is being removed by means of blade graders carried slightly above the ground in such a manner that the oversize is brushed over to the shoulders, where it is either gathered up and hauled away or moved still further into the ditches.

For dust prevention Minnesota uses calcium chloride and liquid bituminous material. Calcium chloride is spread by means of an ordinary agricultural lime sower; bituminous materials are spread by various types of distributors now on the market. In the matter of bituminous distributors, there might be room for improvement on the proper methods through the use of a distributor unit left on the roadway and a number of transfer tanks for hauling the bituminous material from the railroad station or other source to the distributor. This plan has already been tried out in Minnesota with good success.

The maintenance organization does nothing in the way of operating quarries or crushing materials; this is all done by contract.

No electric magnets or other scavenger equipment is being used along roadways to pick up metal scrap, etc.

(D) Surface Treated Types

Cover material, such as sand and gravel, is being spread by blade grader equipment.

No special surface cleaning appliances, such as brooms, etc., are being used.

Bituminous material is spread by standard distributors and

Auxiliary Bituminous Tank

in some cases transfer tanks are used to haul the fluid bitumen from the railroad tank cars to the distributors. It would appear that smaller distributors of 500 gallon capacity, used in connection with a number of 500-gallon transfer tanks, would give a larger output and more economical results than some of the larger units now being used.

Where bituminous surfaces become wavy, they are often corrected by cutting the surface with a heavy blade grader machine during the hot periods of the day; likewise, light surface scarifying and reshaping often gives good results. No special hones or equipment appear to be necessary.

For heating bituminous materials in tank cars or storage tanks, there is need for some better type of equipment to do the work faster and more economically. Present equipment, such as steam boilers, regardless of capacity, seem to work too slow at times.

For mixing bituminous materials, such as for patching work, it may be that some new type of mixer could be developed that would give a more thorough mixing action and at the same time make it possible to clean out the equipment readily. This applies particularly to small units. In Minnesota small concrete mixers are being used, and in some cases the usual mixing paddles have been removed, using only the drum to give the mixing action.

As far as aggregate handling and distributing equipment work is concerned, a great deal of this work is done by contract, and it would appear that the present conveyors, cranes, etc., are suitable for that type of work.

(E) Pavement Surface Types

Center line marking equipment of high speed type of truck mount does not appear to be available on the market, and Minnesota is using a machine of its own design. Recent pavement design, however, tends to eliminate the need of such equipment on concrete, since the center joint together with its 2 inch wide asphaltic cover ribbon, takes the place of the former center line mark. Hand equipment is hardly practicable for pavement marking on account of dangers from traffic.

Crack filling and cleaning is being done quite largely by hand; and if maintenance operations are prompt and efficient, there is not so much need for heavy type equipment. In Minnesota each sectionman is instructed to give his pavement frequent and detailed attention, tending to the cracks and breaks as soon as they appear and before they get so bad that they need heavy duty work done on them.

In the matter of raising pavement slabs, there is a great need for suitable equipment and nothing so far has been developed that seems to be entirely satisfactory.

For bonding new surfaces to old, there seems to have been no need developed for special heating devices.

For breaking up pavement areas for replacement, etc., pneumatic hammers and drop weights are being used. There is a possibility of developing some tool resembling a small pile driver that will go over areas to be broken up at a much more rapid and efficient rate than is now possible.

The cutting down of high spots has not developed as a necessity in Minnesota, except during construction operations and this seems to be taken care of quite easily by the tools already available on the market.

Pre-mixing concrete is a development that fits itself very well to concrete patching work on highways and it is quite likely that it will only be practical where commercial plants already exist. It would hardly be practicable for this department or any municipality to erect and operate such a plant of its own. Premixed concrete has been hauled 15 miles in Minnesota and results were very satisfactory.

Barricades around maintenance work being done on roadways, limiting public use to one-half of the roadway, brings up the necessity of adequate barricades and warning signs. It is hardly possible to designate standard barricades since road conditions, such as vertical and horizontal curvature, would have a great deal to do with the type to be used in any particular place. A generous use of warning signs already suggested for standardization would quite likely take care of all situations. These supplemented by some form of barricade would quite likely give satisfactory service. In Minnesota where equipment is used to carry on operations, this equipment is painted a conspicuous color and parked in a position to protect the workmen. In addition to that extensive warning signs, flags, lights, etc., are used to give advance warning to the road user.

Batching and weighing devices, and other similar equipment for providing suitable concrete for patching material, might find a suitable market in the maintenance field if such equipment can be developed within a satisfactory cost range. On maintenance operations of this nature, the materials used are usually a small proportion of the total cost involved; and it may be found that richer approximate mixes are more nearly the economical answer than the use of expensive and complicated equipment.

(F) Bridge Maintenance

In bridge maintenance the department uses day labor crews and trucks. Each crew has a truck with a power winch, by means of which piles can be driven and material can be moved around if necessary. Pile driver leads are made of structural steel and are readily portable.

Air compressors installed on trucks are used in some cases; the air furnishing power for drilling, riveting, reaming and cleaning.

(G) General

For guard rail painting, hand methods of both cleaning and applying the paint are being used quite largely. There is a chance for the development of suitable units for removing old paint and applying new paint without waste of material.

Minnesota has a large central garage and fifteen district garages, each fully equipped with machinery suitable for taking care of all equipment except major operations. In maintenance work it appears essential that the organization be so arranged that limited areas are somewhat independent of each other; and to avoid the necessity of having equipment standing idle a good proportion of the time waiting its turn to be repaired or possibly spending a great deal of time in transit from a central shop to outlying points, it is quite likely that district shops are even more essential than any one large central organization. A large central organization is almost certain to break down under an over-rush of requirements, such as during a heavy snow removal program or strenuous spring maintenance operations.

Ditch Cleaning and Shoulder Finishing Machine

The equipment being used in district garages for servicing field equipment is as follows:

1 Anvil	3 Chain hoists, 500 lb., 1000 lb., 2000 lb.
1 Milling attachment for lathe	
1 Grinding attachment for lathe	1 Electric motor, 10 h.p.
1 Steel buffer	1 Electric motor, 2 h.p.
1 6-inch blower for forge	1 Press, Buffalo power drill
1 8-inch blower for forge	1 Press, 50 ton
1 Power air compressor	1 Gasoline pump
1 Small air compressor	Misc. pulleys
1 Cutting and welding outfit	1 Refacer, electric valve
1 Drill stand	1 Refacer, hand valve
1 Forge, blacksmith	1 Saw, power hack
1 Power grinder	1 Saw, band
1 Electric bench grinder	2 Trolleys, 3 ton
1 Air alemite grease gun	1 Tank, 1000 gal. gas storage
1 Power hammer	5 Tanks and pumps, oil
1 Air riveting hammer.	Misc. vises
1 Chain hoist, 2 ton	1 Vulcanizer, tire
1 Chain hoist, 3 ton	Misc. emery wheels
1 Lathe, 24 inch South Bend	1 Welding outfit

All purpose work trucks have not been developed or used in Minnesota since the organization in this state makes it possible for a general utility truck to return to its district shop as often as it is necessary to change from one type of work to another. The type of organization we have, which consists of sectionmen, each taking care of most of the work needed on his particular section, does not readily admit of the use of floating gangs centering around an all purpose truck.

Maintenance in California

(A) Clearing, Brushing, Weed and Grass Cutting

This department does little work that could be classed as clearing right of way, and we have no particular suggestions in regard to this point. We have never found any satisfactory machine tools for use in ditching or clearing ditches. There is considerable need for some sort of a ditch clearing machine which could be drawn by a truck or mounted on a tractor and which would pick up accumulations of loose material from the ditch and deposit it in a truck for disposal.

In this state we have little trouble with thawing out culverts. However, we are often obliged to clean out culverts which have become silted up. As an aid in this cleaning, we have devised a four-foot cylindrical shell which is shuttled back and forth through the pipe by means of lines attached to either end, the power usually being provided by either truck or tractor.

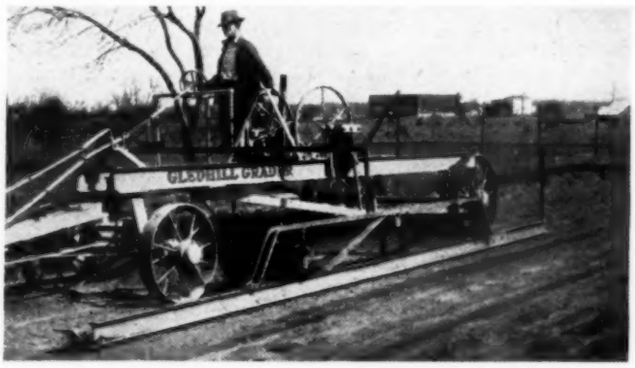
Such brushing that is done is done with hand tools and we have no particular developments to report in this line.

We have experimented a good deal with different types of machines for cutting weeds and grass on right of way, but up to this writing have found that our best results have been obtained with an ordinary mowing machine with rubber tired roller-bearing wheels drawn either by a light tractor or by horses. We have done considerable work in weed eradication by Diesel oil and chemical sprays and have developed a spray unit of two types for use in this work. One of these types is mounted on the rear of a tank truck and the other is mounted on a two-wheeled trailer which is drawn behind the tank truck. Both units employ a small gasoline engine driving a gear type pump and include an over-hanging collapsible arm from which a spray boot is suspended for the application of the eradicator. Our best results have been obtained by the use of so-called Diesel oil with an application of 1/10 of a gallon per square yard. This is applied while the weeds are still green in the spring and has the effect of killing the weeds so that after a week's time they may be burned off. On account of our long dry summers here, it is not feasible to wait until the weeds are dry enough to burn naturally.

Another Type Shoulder Finishing Machine.

(B) Earth Surface Types

Our earth roads are all brought to shape by the use of standard pull type graders drawn by crawler type tractors. On the heavier types of work we have used 12-foot heavy graders and 50 or 60 hp. tractors. On the majority of our work we use a 30 hp. tractor and a heavy 8 foot leaning wheel grader with rubber-tired roller-bearing wheels. We use so-called motor patrol graders for keeping these roads in shape under traffic. We have recently purchased a few so-called dual drive tractor graders and our most recent purchases of this kind have been mounted on pneumatic tires. We find this type to be the most satisfactory for general maintenance work. No earth surface mixture roads have been constructed in this state.



Long Base Tends to Produce Smoother Surface.

(C) Gravel Surface Types

At the present time we are not maintaining any mulch coat gravel roads so can offer nothing on this subject.

Nearly seven years ago this department adopted a standard punching for grader blades which we specified on all purchase orders for graders. A little over a year ago we adopted the American Association of State Highway Officials' punching for grader blades and all graders now are being-purchased with this punching. We have not yet completed the changing over of our older graders to the new punching, but expect to do so within the next year. We have had no difficulty in securing graders with these special punchings and believe that the matter is in fairly satisfactory shape at the present time. We have had little success with the use of any portable crusher units to be operated along roadsides to dispose of excess size surface material. It is generally found in the use of such equipment that it is necessary to transport material to some distance at times and the high cost of such transport seems to render the use of such blades uneconomical. Under our present system of constructing gravel surface roads no excess size materials are permitted to get into the roads. In reconstructing some of our older gravel surfaced roads, we experimented considerably with various types of rakes and other equipment for removing excess size material but without much success.

At the present time our dust prevention measures consist entirely of the application of a light liquid bitumen. This is generally applied with either a standard type distributor or with a distributor boot which is attached to a tank truck. This last method has proven of great assistance in cases where we had long hauls for the bituminous material as it eliminated the delay and consequent cooling of material incidental to the transfer of the bitumen from the tender trucks to the distributor. These trailer boots are mounted on 1½-ton two-wheeled army type trailers, which were secured from the U. S. Government after the close of the World War. They consist of a regulation 8 ft. spray boot with a 2 ft. extension, a 10 hp. 4-cylinder gasoline engine, and a rotary pump together with the necessary

piping and hose. Those used by this department have been built in our own shops at an expense of $1,500.00 per unit. They are used with 1,000 gallon tank trucks preferably mounted on pneumatic tires.

This department has done very little quarry work in the last few years, nearly all of our materials being purchased from commercial sources or produced by contract.

We have never done any work on the removing of metal scrap from road surfaces, as about the time the use of magnets for this purpose first developed, we initiated a policy of oil surfacing as a step in our stage construction work and on our secondary roads where a higher type of surfacing is not justified by the traffic department. With the bituminized surface, little metal scrap accumulated and we have not felt that this measure was necessary.

In general we have used truck cranes or similar units in unloading from cars for stock pile and have on some smaller jobs used a small A-frame and drag scraper operated by a small gasoline hoist. No special feature has been developed in either of these lines.

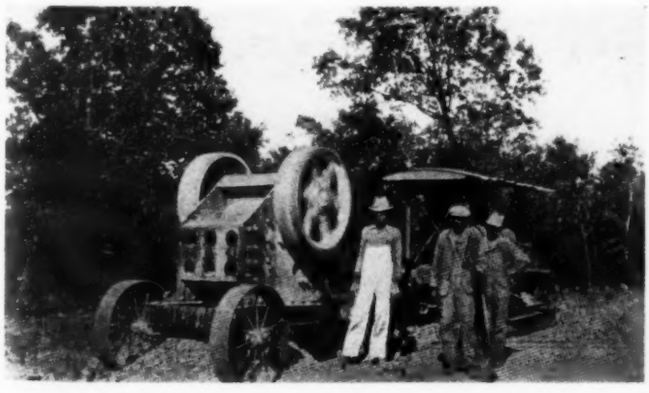
Portable Crushing and Screening Plant

(D) Surface Treated Types

This department has not developed any special equipment for spreading aggregate, it being generally deposited in windrows from trucks or in a layer by the use of spreader boxes after which it is bladed into windrows and reshaped to remedy any segregation which may have taken place in transit.

For surface cleaning we have used almost entirely for the last five years broom attachments for small tractors. These attachments have been very satisfactory. The same type of equipment has been used in the distribution of bituminous surfacing materials as that outlined in dust prevention methods above.

In this state where most of our bituminized roads are in districts remote from railroads, necessitating quite long hauls, we have found the use of the trailer boots outlined above to be of particular advantage. Before these trailer boots were developed it was our practice to use a tender truck to convey the bituminous material from the railroad siding to the site of the work, transferring the same into the distributor upon its arrival at the job. Where long hauls are involved there is no question but what some type of equipment must be employed which will leave the distributor on the job. So far we have not attempted the use of trailers in hauling material from the railroad. In some cases where a long haul was involved and the situation seemed to warrant it, storage tanks have been constructed along the line of the work and the liquid bituminous material hauled out and deposited in these tanks prior to the beginning of operation. One advantage of this method is that the treatment work itself can be pushed through to completion in a shorter time, thus minimizing the inconvenience to the travelling public.



Traveling Crusher.

Minor irregularities in treated surfaces have been removed by the use of a heavy motor patrol. In light bituminous treated surfaces, where the entire surface becomes wavy, we have found it better to scarify and reshape the entire surface, adding fresh bitumen and rock if necessary. The waviness in asphaltic concrete surface is removed by a long wheel base machine, equipped with chisel teeth for cutting down irregularities, followed by a blade to remove the loose material from the roadbed.

For lighter fluid bitumens where temperatures of not over 200° F. are required, we have found that the steam coils in the cars furnish a very convenient method of heating the material. For bitumens of a higher asphaltic content, where a higher temperature is needed, after being heated in the car to approximately 200° F., it is pumped to a portable retort and thereby brought to the desired temperature.

This department has not put down any "plant-mixed" projects by day labor, and we have no special information concerning the equipment used by contractors on their jobs of this nature. For small batches of pre-mix for patching purposes we have utilized ordinary concrete mixers of the tilting type with very good results. No special equipment other than that listed above under gravel surfaces has been developed for handling aggregate.

(E) Pavement Surface Types

This department has done considerable experimentation in the past with different types of center line markers but finally standardized on one machine. We have modified these machines considerably and have secured considerable improvement in performance by so doing. Modification consists mainly in pneumatic tires in place of the solid tires furnished with the machines and the reconstruction of the pilot wheel frame to give a more rigid mounting.

Cracks are filled with a one gallon cornucopia shape pouring pot equipped with a shut-off valve operated by a plunger attached to the handle of the pouring pot. Compressed air, furnished by the power tire pumps mounted on our trucks, has been used to a small extent for cleaning cracks.

Barricades used to protect constructing operations are similar to an ordinary carpenter's horse but are so arranged as to collapse for convenience in hauling. These barricades are supplemented by "Men at Work" signs placed approximately 400 feet in each direction from the site of work.

(F) Bridge Maintenance

One unit is operated by this department at the present time consisting of a three-ton truck with a 160 foot displacement compressor driven by a gasoline engine mounted thereon. This compressor is used to operate a sand blast for cleaning steel bridges and also spray guns for repainting the same. The sand blast and dryer are mounted on a trailer which is pulled by the truck between jobs.

Equipment of the outfit also comprises staging, block and tackle, carpenter's tools, a pneumatic riveting hammer as well as bars, etc., needed for making minor repairs of the structures.

(G) General

Guard rail painting in this state is done by hand. Our traffic striping machines are all equipped with an extra gun, and these are used to a small extent on this work. We also have several small spray paint outfits which are used on the larger jobs.

Major equipment in this state has for nearly seven years

Truck Crane Pile Driver

been in charge of a separate equipment department which maintains all the equipment, collecting rental from the other subdivisions of the department for it. Under this system, a large central shop is maintained at Sacramento where most of the special machinery is constructed, and shops in each district with the tools necessary for the ordinary upkeep of the equipment used in that district. In addition to this, on major bituminous or other large day labor operations, a field mechanic is kept on the job to make necessary minor adjustments. This department maintains no field garages.

Equipment in our district shops varies quite largely with the class of work being handled and the possibility of local supply of parts needed. Cylinder grinding outfits are maintained in Sacramento and Los Angeles, and these two shops are also equipped for grinding pistons, crank shafts, and other work of this nature. These shops as well as all the rest of the district shops are equipped with lathes, drill presses, electric drills and grinders, and include a fully equipped blacksmith shop as well as a complete line of hand tools.

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Relation of Speed to Highway Capacity

Interesting disclosures regarding the relation of speed to the capacity of a highway are set forth in the report of a recent study of vehicular traffic, according to California Highways and Public Works; it is shown that increasing the speed at which traffic is moving does not necessarily increase the number of cars passing a given point for a fixed period, as would naturally be thought. Theoretically, the faster the traffic moves, the greater the number of cars passing a given point per hour, thus increasing the capacity of the street and the amount of vehicular traffic which it can handle.

From a practical standpoint, however, this is not true because as the speed increases, the distance between automobiles required for safe driving also increases. The studies show that at speeds higher than 23½ miles per hour the safe distance necessary between the cars increases so rapidly that it more than counteracts the increase in speed with which traffic is moving and, in fact, reduces the number of cars which can pass a given point per hour with safety.

As an illustration it is shown that at 23½ miles per hour a safe hourly capacity of the traffic lane is 2,600 cars. At 45 miles per hour, although the speed is almost doubled, the safe distance between the cars has more than doubled and the capacity is but 1,760 cars an hour.

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19th Purdue Road School

The 19th annual Purdue road school will be held Jan. 23-27 at Purdue University, Lafayette, Ind. It will be held under the auspices of Engineering Extension Department and School of Civil Engineering of Purdue, in cooperation with Indiana State Highway Commission, County Highway Superintendents' Association, County Surveyors' and County Engineers' Association, and Highway Materials and Equipment Association. An excellent program including addresses by outstanding road officials and engineers from Indiana and other states, has been prepared. There will be two days of general sessions and one and one-half days of separate group sessions.

Special features of the school include: Smoker (no dinner) in Memorial Union Building, Monday night, Jan. 23. Student vocal trio, black magic, movies from the U. S. Bureau of Public Roads, smokes, etc. Road school banquet, Memorial Union Building, Thursday night, Jan. 26. Guest speakers of note. Road show—exhibit of materials and equipment, Purdue Armory, Tuesday night, Jan. 24, Wednesday afternoon and night, Jan. 25. For information relative to exhibit space, get in touch with Mr. C. A. Wilson, Secretary, Highway Materials and Equipment Association, 345 E. South St., Indianapolis, Ind.

W. A. Knapp, Professor in Charge, Engineering Extension Department, and Ben H. Petty, Professor of Highway Engineering, are in charge of the school.

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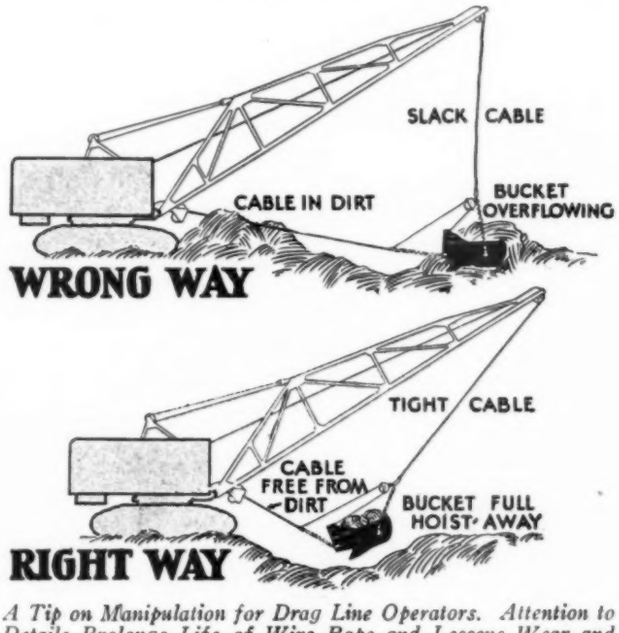
Township roads have great local importance. They offer short connections between state highways, give outlets to villages and communities, provide the farmer with roads to market and to school and church, make the doctor available at all times of year, bring trade to wholesale and retail merchants, facilitate the transit of manufactured articles, relieve congestion on the main highways, give access to the great outdoor playgrounds of the state and allow hunters and fishermen to reach their objectives.—*Gifford Pinchot.*



A Tip on Manipulation for Drag Line Operators. Attention to Details Prolongs Life of Wire Rope and Lessens Wear and Tear on Machinery.

OBSTRUCTIONIST!
New Name for
DIVERSIONIST!

From now on it's highway taxes for highway purposes only. It means real jobs for the unemployed. It will help avoid the dole and the bread line. Keep road dollars on the road

ONE of the most serious steps government can take is to increase taxes. No old tax should be raised, no new tax considered until it is clearly seen that even after strict economy and efficiency measures have been introduced that a need still exists for additional funds.

Citizens of the several states ask two things: That a real economy and efficiency program be inaugurated; that if such a step will not entirely meet unemployment relief needs, a fair and equitable tax, bearing on all citizens, be adopted—and none other.

It has been proposed in many states that additional funds be diverted from motorist-contributed road income to unemployment relief. Also a general sales tax has been suggested.

As for the proposed diversion, motor vehicle users and all fair-minded citizens oppose it and for good reasons. These are summarized in the following paragraphs.

On reasonable grounds, the road users of the United States object to this misuse of their money:

1. Diversion places an unfair burden on motorists alone which should be borne by the public at large.
2. New York State road users, as an example, not only pay all the costs of State highway construction but also more than one-third of local road costs.
3. Diversion throws into the discard the principles upon which road user taxes are based and violates the state laws.
4. Diversion reduces jobs and therefore is not in keeping with the Federal program of unemployment relief.

A hangover from bygone days is the thought that the possession of an automobile indicates wealth. Aside from the desire to have an automobile for social or entertainment use, people in the low or moderate income groups have an infinite number of practical reasons to own cars. Factories located in suburban areas, homes in the country away from high rents, the inadequacy of other means of transportation, cash and carry shopping, all make the motor car a necessity.

Consequently, the following facts announced by the National Automobile Chamber of Commerce are not startling:

Eighty-six per cent of all cars sell for less than $750 wholesale.

Forty per cent of all cars are owned by people of annual incomes of $2,000 or less.

Nearly two-thirds are possessed by people with incomes of less than $3,000.

So when road users are forced to pay the costs of general government through diversion simply because they own automobiles the result is class taxation—on people who for the most part are least able to meet the bill.

Use Motor Taxes for Roads Only.—The chief reason against diversion is that the motor vehicle users do not want it. The gasoline tax was created as a road toll so that the road user may pay for maintenance and new construction of roads in proportion to his highway use.

Road users have taken a tremenedous burden away from property by assuming all the cost of state highway building and a large share of the cost of local road building. Motorists have supported the gas tax wholeheartedly for among other things it brought the states good roads at a more rapid rate than otherwise would have been possible. To impose a general government cost on motor vehicle users is distinctly unfair in point of ethics and in point of all the motorists have done for the states at great expense.

Road users can afford to pay the present tax rates only so long as the money is spent for road improvement. They have been willing to bend over a little, by permitting high tax rates, because of the vastly improved motor facilities held out for them in the future.

Illinois Situation.—There is every likelihood that diversion of current road income would reduce motoring, bring a further reduction in road income. It must not be forgotten that already some $11,000,000 has been removed from state road funds of Illinois to meet tax anticipation warrants, and if this money does come back to highways it will not be in the near future. In addition, Illinois this fall voted on a $20,000,000 bond issue, to be financed by gas tax income, for unemployment relief. This money has already been spent.

Frank T. Sheets, chief engineer of the Highway Department, recently reported that a deficit of more than $700,000 will face the department by December 31. This all means that even now diversion has wreaked considerable havoc in the state highway program of Illinois.

It, therefore, follows that less road progress is being made. As road funds decline important road projects must be abandoned. So in rural areas and in cities sorely needed improvements must be postponed. Bad roads and congestion do not breed motoring; rather they retard road usage and that lessens road income.

So if less money is available for roads, because of diversion and lessened road usage, sorely needed motor facilities would remain unbuilt. Then there are bridges to be constructed, pavements to be widened, separated grade intersections to be built; all in all, the states must continue to keep their road dollars for roads, their road funds and taxes inviolate.

New York State Action.—The gas tax was created in Oregon in 1919 purely as a road toll whereby motorists paid for roads in proportion to their use of them. Ore-

GET WHAT YOU PAY FOR, MR. MOTORIST

The New York State Construction Council invites you and your neighbors to join a state-wide group of tax-payers who are fighting for their rights—your rights. Here is all they demand:

1—That gas taxes and registration taxes shall not be increased;

2—That money from these taxes shall be used only for highway purposes, according to law.

To understand the situation, consider these facts. Taxes of New York State motorists were first increased $21,000,000; this made the total state tax, paid by motorists, $93,000,000, which the law says must be used for roads.* But the Legislature took more than half ($51,000,000) for other purposes.

This reduced the state highway program several hundred miles. It took employment away from many thousands of men who need work on roads—and from more thousands who need work in quarries, cement mills, machine shops and elsewhere.

Do you want proof? Subdivision 3, Section 289-D of the Gas Tax Law says that one-quarter of the tax shall be refunded to counties and New York City; the three-quarters kept by the State "shall be .... used for the construction, maintenance and repair of highways and bridges..."

Subdivision 4, Section 73 of the Motor Vehicle Law says that the State shall use all the money collected under that law "for construction, reconstruction and repair of highways and bridges...."

In 1931 the law was obeyed. But not in 1932. To see what happened, read the figures in the middle of this sheet.

The increased tax of $21,000,000, the State collection of $93,000,000, the diversion of the $51,000,000 are all matters of record in Albany.

HOW THE ROAD TAX DOLLAR IS SPLIT UP

	1931	1932
1—Added taxes this year, used for "general expenses" of State government	0.00	23½¢
2—Used for "general fund," instead of on highways, contrary to the laws of 1929	0.00	23½¢
3—Refund to New York City and Counties	25¢	25¢
4—Maintenance of existing highways	10½¢	19½¢
5—Construction of new highways and reconstruction of old highways	47¢	14½¢
Totals	77½¢	$1.00

Last year out of every 77½¢ that you paid in road tax you got back 69½¢ in road values. This year each 77½¢ is raised to $1.00—and you get back 47¢. Next year it is proposed to cut out ALL highway improvement. But you'll still pay the tax.

When is this to end?

Diversion of such taxes is unfair to motorists, constitutes class legislation, encourages and conceals extravagance in other departments of government, and is contrary to the laws of 1929.

This year, you pay $1 tax for every 25 gallons of gas you buy. In addition, you pay for license tags and tax on oil. The tax costs you about half as much as the gasoline.

By all means talk to your local candidate for the Legislature against diverting road tax money to other uses. Make sure that it does not happen again.

Demand that every candidate declare frankly and publicly how he stands on the questions of increasing road taxes and of using road taxes for other purposes. Do it before election day. Vote for candidates who oppose diversion and oppose increased motor taxes.

Only in that way will you get the road work that you pay for. At the same time you will help to give jobs to thousands of men, and increase business.

From now on it's "highway taxes for highways only." This means real jobs for the unemployed. It will help avoid the dole and the bread line.

Join the movement right now!

*WITH THE FEDERAL GAS TAX OF 1¢ AMOUNTING TO $15,000,000, THE TOTAL MOTORISTS' TAX IN NEW YORK STATE THIS YEAR IS $108,000,000!

NEW YORK STATE CONSTRUCTION COUNCIL
515 Taylor Building, Rochester, N. Y.

Fac-simile of a Placard 17 *by* 24 *Inches Posted in Prominent Places in New York State*

gon adopted the gas tax to get funds for sadly inadequate highways. Shortly, the wisdom of the gas tax spread and now it is used in all states. New York was the last state to adopt it because of the large return from motor license fees that go with such a populous state.

But after only three years of service in New York as a road toll, diversion was introduced in 1932 through the loophole of adding one cent to the starting rate of two cents. The extra cent, plus the increased motor vehicle registration fees, was avowedly for the general state budget—not for roads—and it swelled the income from motorists by $21,000,000. But despite the clearly worded Motor Fuel Tax and Vehicle Law, an additional $30,000,000 was diverted away from roads and the 1932 diversion became $51,000,000. So more of the motorists' money was used for miscellaneous purposes in 1932 than for highways.

This is directly in the face of the fact that motorists can afford to pay user taxes only so long as that money is spent for road betterment. The vast majority of car owners are of limited or moderate means, so a large share of their income must be devoted to gasoline, oil, tires, repairs and so on. It costs plenty to be a motorist without taxes. Taxes levied for road improvement, however, carry the solace that they reduce motoring costs and make travel safer. Accident records are a deadly testimonial for the need of safer highway facilities.

Nature of Gas Taxes.—Motor vehicle tax incomes are road earnings, nothing else. These earnings have placed highways on a self-sustaining basis. To divert these earnings is to deprive motorists of their just return. Continued diversion of motor tax funds would destroy highway progress and stifle the most important means of transportation. That is illogical for presumably intelligent states.

Taxes on motor vehicles, the license fee and the gas tax, were created as a means of obtaining funds for the maintenance and construction of highways, and making the state highway system wholly self-supporting. Many state license fees are a fixed charge levied on the basis of horsepower which presumes a relationship with the size and road destructive power of the vehicle.

Work Benefits of Gas Taxes.—The nation has recognized that the alarming jobless condition can only be answered by an unstinted effort on the part of governments, large and small, to provide jobs. Billions are now being made available by the federal government with but one major objective—the giving of jobs. Most of the states and local communities have accepted this view, yet many are accepting federal help with the one hand and with the other they are nullifying the splendid efforts of the federal government.

Had the federal government felt that states would wilfully create new numbers of jobless by stopping job-giving activities, no federal cash would have been proffered. The states, in many ways, are assisting in the nationwide effort to create jobs. Yet through diversion of road funds they are guilty of obstruction.

This is all the more clear when it is realized that few, if any, industries provide a greater distribution of money to labor than highway building. Of every dollar sent out to build a road ninety cents goes quite promptly into the hands of labor through many outlets, declares the U. S. Bureau of Public Roads. For each man you see working directly on the road project there are two others you do not see who are manufacturing and transporting material and equipment.

Certainly highway building is one of the few industries in which men can be kept at work producing facilities which can be immediately used by the public with profit and pleasure without flooding a market and without the necessity of selling the thing produced before it becomes usable. Diversion of highway funds adds fuel to the unemployment flames; continued highway building provides against the jobless situation.

Effects of Diversion.—Taking money away from road funds for unemployment relief defeats its own purpose. Men are thrown out of road jobs by the thousands; relief needs increase. Diversion intrenches the dole. The public gets nothing in return for its money, but of greater importance, the business let-down will last indefiniteley if government continues to make it impossible for men to get jobs. So by keeping the road dollar where it belongs, the states will not contribute further to the deplorable jobless conditions.

The General Sales Tax.—As was aptly stated by one citizen, there are other people in this world besides motorists. The general sales tax has been proffered as a solution to the problem of obtaining funds to carry on unemployment relief. The general sales tax is worthy of very serious consideration: for precedent there are Mississippi and Pennsylvania.

Reduction Damage

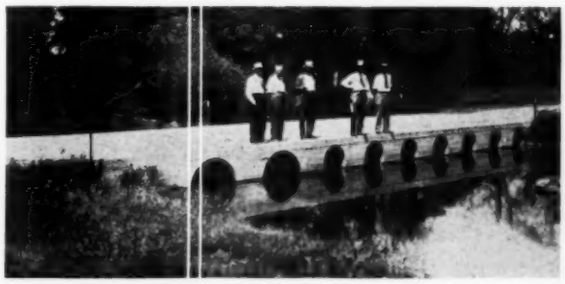
President Hoover recommended $65,000,000 decrease in Federal aid. This will seriously handicap highway programs for 1933.

Henry Shirley, Virginia State Highway Commissioner, states that such a curtailment would throw 7,000 men out of work in Virginia, as well as greatly restrict new road activities.

DRAINAGE—
The Basic Highway Problem
Employing the Corrugated Pipe

A First Boil Subdrain Installation. Digging a trench for an 18 in. perforated pipe on Route No. 122, in Ohio.

Highway Subdrainage. Ground water is often so close to the subgrade that the soil is completely saturated and does not offer proper support for the loads that come upon it.



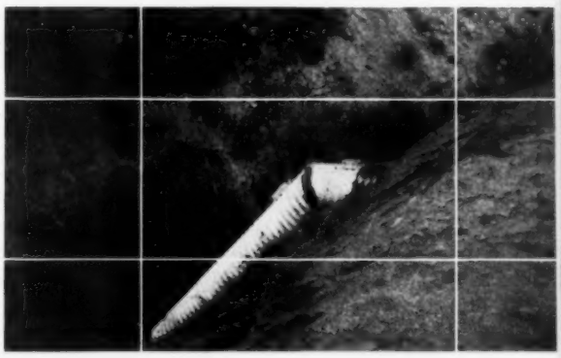
Dry Weather Ford Over Creek. Installed on a county road of gravel construction except the portion that is overflowed during high water. This portion is of concrete protected by a concrete wall to prevent it from washing out. Shelby County, Indiana.

A Subdrain Installation. The soft spot has been drained with an 18 in. pipe and the surface repaired.

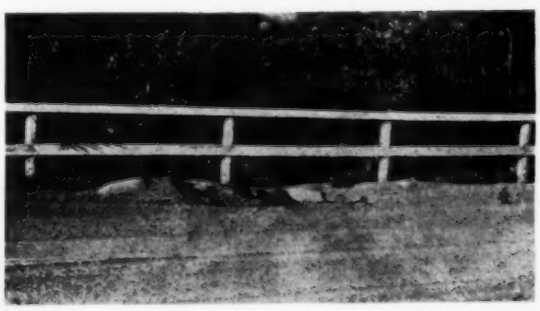
Wash Prevention. This 18 in. pipe was extended 10 feet over the embankment on Black Canyon Highway, Mayor, Arizona, to prevent surface water which drained off of the road from washing gullies down the side of the fill. As a rule every effort should be made to install a culvert so that the discharge will be beyond the toe of the fill slope. In cases where this cannot be done, it is advisable to extend the culvert so the discharge will fall beyond the fill.

A Catch Basin. This installation conducts surface water to a parallel drain.

Above—Ditch Enclosure in Ohio. Below—Entrance Culvert. Consolidated schools owe their existence to good roads.



Above—Culvert Extension. Confining surface drainage down a slope prevents erosion. This installation is in "Flintridge," a subdivision of Pasadena, California.



Erosion Prevention. This typical 8 in. shoulder drain is on State Highway No. 24 in Nebraska.

Right—Highway Crossing Drain. Replacing wooden bridge.

ANTIQUES

STONE STREETS

1790 Second Street in Newcastle, Delaware, was built in 1790. It and two other streets in Newcastle—Third Street and The Strand—are still in service.

1790 This close-up of Second Street in Newcastle, where William Penn spent his first night in America, is built of stones. The larger stones were laid in rectangular pattern end to end, and the hollow rectangle filled with smaller stone.—Staff photos.

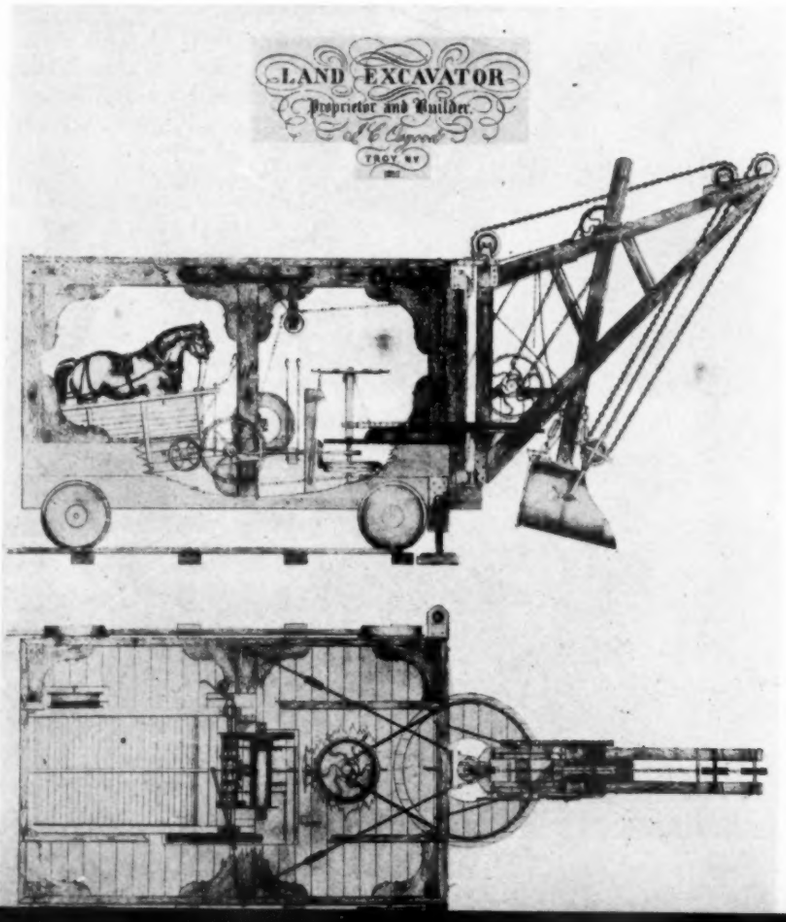
POWER SHOVEL

Development of the power shovel preceded the present effective operation of other mechanical highway construction equipment and, like the rock crusher, marked a turning point for increased annual mileage of highways constructed. Naturally, reduction of cost per unit of material moved is the factor which was responsible for making this possible.

This early design, made by J. C. Osgood, founder of The Osgood Company, now located in Marion, Ohio, was for a "two horsepower" "Land Excavator." The power was taken from the forward roller shaft on the treadmill to the countershaft through gears. Two pinions were loose mounted on the countershaft and engaged by sliding jaw clutches. The pinions engaged the gears on the drum shaft to furnish power for hoisting.

Two sliding bevel gears operated by hand levers were also mounted on the countershaft. These could be moved into mesh with a bevel gear on a longitudinal shaft to swing the boom in either direction. The longitudinal shaft had a bevel gear on the forward end which meshed with a bevel gear on the vertical shaft. The chain operating from the chain sprocket on the vertical shaft moved the swinging circle in either direction, depending upon which of the bevel gears on the countershaft had been engaged with the bevel gear on the longitudinal shaft.

1852



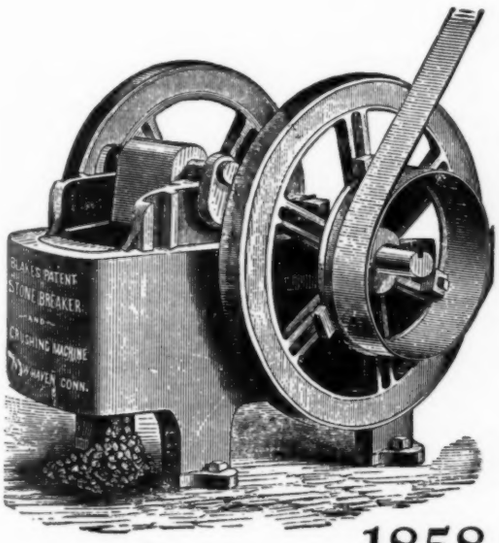
OR

THE MARCH OF TIME

1905

A PIONEER

This early Best 9-passenger automobile never got into production, but a year before the San Francisco earthquake-fire it was one of the "horseless age" sights around San Francisco Bay. Benjamin Holt was about ready with the first "Caterpillar" tractors, but both Holt and Best were leading the tractor field on the Pacific coast with their powerful wheel tractors that were widened out to as much as 18 feet in each ground wheel to give traction on swampy lands.



1858

STONE BREAKER

Before McAdam's day, and indeed long afterward, stone for roads was broken by hand. In 1858 Eli Whitney Blake, a manufacturer of New Haven, Connecticut, invented the first machine stone crusher, "the Blake stone breaker." Its earliest employment was for crushing stone for the roads in Central Park, New York City, which were then being built.

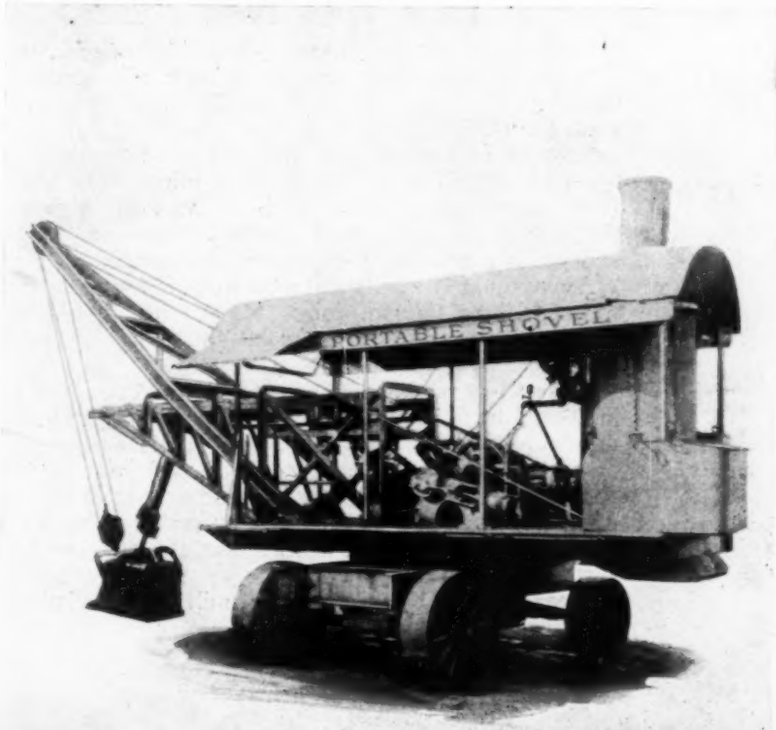
A few years earlier than McAdam the following indicates methods in vogue: "In breaking stones for roads, the best method is to have them broken by persons sitting, and using small hammers. A hard stone should be used as an anvil."

POWER SHOVEL

The first full revolving Thew shovel built was designed and built by Captain Thew in 1895 for use on the ore docks, where a machine capable of digging or loading in any direction of a 360° circle was very much in need at that time.

A steam shovel, according to Kirby and Laurson, was invented as early as 1838 by William S. Otis of Massachusetts. It was mounted on wheels and was capable of handling a thousand cubic yards daily. Whistler used the machine on the Western Railroad in Massachusetts and on other American railroads. When it was taken to England it was christened the "Yankee Geologist" in 1843. Along about this same time one Gervais of Caen, Normandy, France, invented a locomotive excavator — it was 1839 or earlier, which he called the "Terassier Locomoteur."

1895



Fill *SETTLEMENT* Data

SETTLEMENT of fills is a development in highway practice which is yet in its formative stages. Considerable experienced judgment as to quantities of explosive and methods of employment must be exercised to get satisfactory results. To eliminate some of the variable factors, engineers for the Du Pont company have developed the following four page data sheet on which they partially base their recommendations:

Page 1

FILL SETTLEMENT DATA

LOCATION OF PROJECT

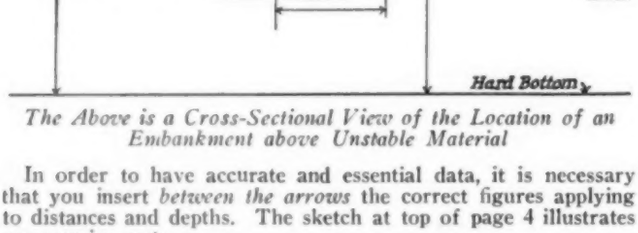
State..... County..... Place.....
Highway No. Federal ☐, State ☐ or County ☐
Project Number.....
Supervising Engineer:..... Location Address: .....
Official Address:.....
.....

DESCRIPTION OF FILL SETTLEMENT PROJECT

(NOTE: If blue-prints, photographs or other records are available, it is suggested that they accompany this description. They will be returned with our proposed plan of procedure.)

Page 2

DATA REQUIRED

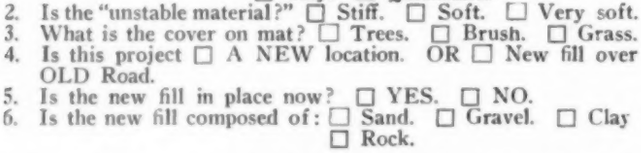


The Above is a Cross-Sectional View of the Location of an Embankment above Unstable Material

In order to have accurate and essential data, it is necessary that you insert *between the arrows* the correct figures applying to distances and depths. The sketch at top of page 4 illustrates our requirements.

Please reply to the following questions:

1. What is the type of "unstable material?" ☐ Muck. ☐ Peat. ☐ Marl. ☐ Mud. ☐ Clay. ☐ Quicksand.
2. Is the "unstable material?" ☐ Stiff. ☐ Soft. ☐ Very soft.
3. What is the cover on mat? ☐ Trees. ☐ Brush. ☐ Grass.
4. Is this project ☐ A NEW location. OR ☐ New fill over OLD Road.
5. Is the new fill in place now? ☐ YES. ☐ NO.
6. Is the new fill composed of: ☐ Sand. ☐ Gravel. ☐ Clay ☐ Rock.



Furnish - Bottom of Fill Profile
Furnish - Hard Bottom Profile
On the Above Cross-Section, Indicate (1) the Profile of the Bottom of Fill. Also Show (2) the Profile of the HARD BOTTOM

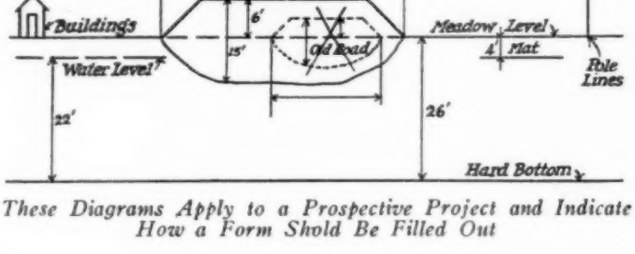
Page 3

RECOMMENDATIONS

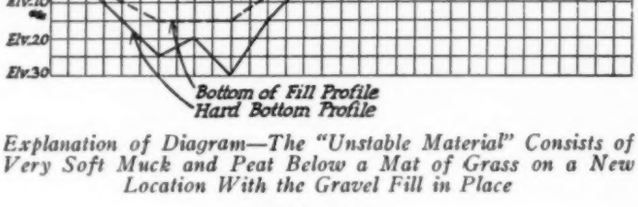
Highway No..... in.....State of.....and identified as Project No.....

Page 4

SAMPLE DIAGRAMS



These Diagrams Apply to a Prospective Project and Indicate How a Form Shold Be Filled Out



Explanation of Diagram—The "Unstable Material" Consists of Very Soft Muck and Peat Below a Mat of Grass on a New Location With the Gravel Fill in Place

REMARKS:

Illinois Tries New Joint

In October last, an interesting installation of a new type of all metal joint was made on a mile and half stretch of concrete road on Route 122 running east and west from Manerre to Hopedale, Illinois. After many months of experimental testing and work on different types of expansion and contraction joints, both in the Bates experimental road and in various highways throughout the state, the highway commission decided to try this new type of expansion and contraction joint.

Approximately a mile and a half of highway was constructed, three sizes of joints (⅝, ¾ and 1½ in. air compression spaces) being installed transversely across the road at varying distances.

Close attention was accorded to the time required for installing the first joint. Just 4½ minutes elapsed before the first joint was in place, covered with concrete and properly screeded. In placing the second joint, 50 feet further on, this time was cut to approximately 3 minutes without stopping the machine or breaking the batch. And when the fifth joint was in place, the time had been further cut to only a minute—a speed maintained throughout the balance of the mile and a half of construction.

Equipment and Materials on Display at the 1933 Road Show

IN the following pages ROADS AND STREETS presents its annual preview of the Road Show exhibits. All the exhibits are described upon which information was available up to the time of going to press.

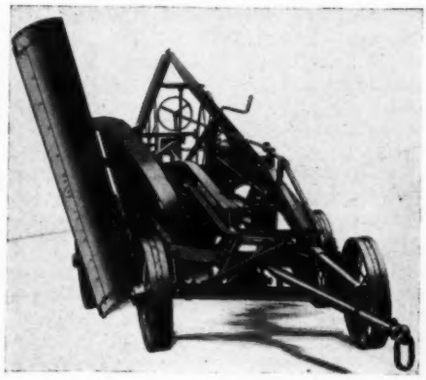
Abrams to Show Uses of Aerial Surveys

The exhibit of the Abrams Aerial Survey Corporation, Lansing, Mich., will show a close parallel and the overlapping interest between the providing of highways for ground transportation and the providing of runways for airplanes. The exhibit will also show the uses to which the airplane has been very readily adapted to perform the old and respected method of making surveys in a new and unusual way. The exhibit also will show the advantages to be gained by using aerial surveys in highway location work and other large projects. The exhibit will show aerial surveys as they have been used for establishing primary and secondary highways, transportation system around congested areas, how they are used in city zoning and planning, solving tax assessing problems, and the projection of lines of communication through rugged and inaccessible country.

The Abrams contour finder, which has been developed and patented by the Abrams Aerial Survey Corporation gives to aerial photographs and aerial survey maps the prospective of depth, or the third dimention, and it is this feature of the exhibit which attracts considerable attention of the engineers and invariably they readily appreciate the advantages to be gained by this new service. It is possible with the contour finder to study the exact contour of the ground, height of trees, buildings, etc. With this instrument and a very small amount of ground control it is possible to produce a contoured map, extremely accurate and at a small cost compared to the usual contoured methods. In many cases it has relieved the necessity for preliminary ground survey on highway, transmission and pipeline work and it is especially valuable in city zoning, etc. These instruments are not offered for sale but are licensed out for use with the Aerial Survey maps made by the Abrams Aerial Survey Corporation as a part of the service they offer.

J. D. Adams to Show Grader

The J. D. Adams Co., Indianapolis, Ind., exhibit will be located in Spaces 135 and 140 near the entrance to the building. Their exhibit will consist of the following machines: Adams motor grader No. 301—a new motor-controlled machine brought out in 1932 and powered by McCormick-Deering Tráctor. Adams elevating grader No. 11—also a fully motorized control machine which has created quite a sensation among dirt moving



New Adams Grader.

contractors. An Adams leaning wheel grader of the high-lift type. A new grader just being announced is the No. 112, with 12-ft. blade, illustrated herewith. This grader has a wide range of blade adjustments, being capable of cutting a bank 6½ ft. high at a slope of 73 degrees off horizontal. It also cuts 6½ ft. outside the line of wheels for finishing shoulders, etc. —9½ ft. with a simple moldboard extension. Outstanding mechanical features are new all-electric-welded construction, machine-cut, enclosed gears throughout, machine-finished bearings and ball and socket connections adjustable for wear and antifriction bearings in the wheels. The Abrams exhibit will be in charge of E. E. Christena, assisted by a number of company representatives.

Alabama Asphaltic Limestone Co. Exhibit

The exhibit of the Alabama Asphaltic Limestone Co., Birmingham, Ala., will consist of samples of asphaltic limestone hot mix and cold lay paving. Also a special cold lay mixture developed for thin seal coats on mixed-in-place or road mix construction. This mixture is spread with a blade in quantities of from 12 to 30 lbs. per square yard over the road mix surface. Alabama limestone rock asphalt seal coats on road mix have been used very successfully during the present year and have excited very favorable comment among engineers. The exhibit will be in Space 338 and the company will be represented by W. L. Caldwell, President, and J. H. Conzelman, General Manager.

American Manganese to Show New Shovel Dipper

The American Manganese Steel Co., Chicago Heights, Ill., will occupy Booths No. 230 and 235. The representatives at the show will be: A. W. Daniels, Vice President; J. P. Murtaugh, Assistant to Vice President; A. R. Sittig, Cleveland District Manager, B. S. Carr, Manager of

New Amsco Renewable Lip Shovel Dipper.

Pump Department; P. I. Nagle, Pump Department. Among other things to be exhibited is the new Amsco manganese steel renewable lip, one-piece, power shovel dipper

American Concrete Expansion Joint Co.

The American Concrete Expansion Joint Co., Chicago, Ill., will exhibit a new expansion joint for concrete. Two full lengths of its Ace expansion joint, two full lengths of its construction joint and sections of each, cast in concrete, will be shown. James Jacobson, President, Eric Hall, Vice-President and Treasurer and M. E. Payne, Assistant to the President, will be in attendance.

Amiesite Asphalt Co. Exhibit

The exhibit of the Amiesite Asphalt Co., Philadelphia, Pa., will consist of samples of its materials in the finished and in the raw state. Also motion pictures showing the application of "Amiesite" pavements and "still" photographs showing installations of "Amiesite" pavements, also the company's plants. Literature describing its products and processes will be available. All of these exhibits have been found in the past to be very interesting to the delegates at the show and the company is continuing the same policy which has been found a very satisfactory one The company will be represented by D. M. Hepburn, President, Amiesite Asphalt Company of America; Perry A. Nicklin, Sales Manager, Amiesite Corporation. Harlan Conly, Treasuretr, Amiesite Asphalt Company of America and Amiesite Corporation. Charles P. Elliott, Engineer, Amiesite Corporation. In addition the following representatives will be pres-

ent: Richard Halton, Millard Hunt, Robert H. Fuller, W. H. Hall, Edward McLaughlin, Geo. B. Carey, J. E. Cushing, C. A. Harrington, S. E. Johnson, Wm. S. Giles, Paul Townsend, Jos. Spears, Wayne C. Sutton, W. C. Bechtold, W. G. Drummond, W. C. Witt, M. F. Bramley, Harold Bramley, Geo. Vang, M. E. Payne, B. Dolan. The headquarters for the Amiesite representatives will be the Statler Hotel.

Amplex Mfg. Co. to Exhibit

The Amplex Manufacturing Co., Division of the Chrysler Corp., Detroit, Mich., will exhibit three engines. The exhibit will be in Booth 205 and D. E. Nims, P. J. Hilgendorf, J. S. Wardwell and F. C. Baldock will be in attendance.

Anthony Co. to Show New Multiple Tool Digger

The Anthony Co., Streator, Ill., will show its new shovel on the caterpillar tractor. The exhibit will be in Space 128 opposite the caterpillar exhibit near the main entrance. There will be a motor hooked up to the unit, so that the unit will be operative and can be demonstrated. This multiple tool is many tools in one; that is, by interchange of parts the unit can be used as a bulldozer and changed into a fresno, or into a loading machine. It is a one-lever machine, but the hydraulic power and the swinging and other necessary movements of the machine are part of the caterpillar tractor and not the loader. A short description of the mechanism is—simply a pump driven off the power take-off at the rear of the tractor; a cylinder for lifting the four-roller dolly, which operates in a channel track.

Asphalt Institute Exhibit

The Asphalt Institute booth space is numbered 126 to 132 inclusive. The exhibit will include a model showing asphalt road construction. Latest publications of the Institute will be available, including the newly simplified specifications for liquid asphaltic road materials and Manuals No. 1 and No. 2 of the asphalt road construction series—the latter on surface treatment types being just off the press. Representatives of the Institute attending will include J. E. Pennybacker, Managing Director; Prevost Hubbard, Chemical Engineer; Bernard E. Gray, Highway Engineer; Henry Krieger, Assistant Chemist.

Associated Equipment Distributors

The Associated Equipment Distributors will occupy Booth 343. There will be no exhibit, however, the space being equipped for the comfort of the members attending the show.

Barber-Greene to Show Movies of Its Paver

Barber-Greene Company, Aurora, Ill., will occupy Booths 206 and 207. The principal feature of the exhibit will be the interesting 32-minute movie on the details and experiences of the Barber-Greene bituminous paver and finisher. A sound accompaniment will explain in detail the machines and operations shown. Since movies were shown last year, it might be well to explain that only a few feet of last year's film is included in the film to be shown this year. The movie includes work in Wisconsin, Illinois, Kansas, and Indiana. Not only does it show the Barber-Greene bituminous paver and finisher working together, but jobs on which the paver only was used, and a job where only the finisher was used, being fed by trucks. Still pictures of these jobs and many more will also be on exhibit. There will also be movies of many other Barber-Greene machines in operation, which will be shown upon request. These films include ditchers, loaders, and conveyors. Special films on Barber-Greene belt conveyors handling wet concrete will be available for those who desire to see them. These films include the Merchandise Mart, where 55 Barber-Greene conveyors were used for handling all of the concrete. Chairs will be arranged for the convenience of visitors viewing the films.

Barrett Exhibit

The exhibit of the Barrett Co., New York, this year in Space 142, will include roofing and building material in addition to the Tarvia and Tarvia-lithic line which has been exhibited in the past. Latest Barrett materials will be shown and their use illustrated. The following representatives of The Barrett Company will be present at the Road Show: P. K. Sheidler, Assistant Director of Sales, New York; O. A. Brand, Manager, General Tarvia Department, New York; Paul Macy, Assistant Manager, General Tarvia Department, New York; Geo. E. Martin, Consulting Engineer, General Tarvia Department, New York; J. L. Lien, Manager, Tarvia Department, Chicago; A. D. Carpenter, Manager, Tarvia Department, Minneapolis; F. E. Banville, Manager, Tarvia Department, Columbus; C. H. Olmstead, Manager, Tarvia Department, Birmingham.

Bay City Shovels Exhibit

Bay City Shovels, Inc., Bay City, Mich., will exhibit a Model B, ⅜-yd. light ½-yd., full-revolving, full-crawler mounted convertible crawler shovel with chain crowd, frictionless bearings, unit alloy heat treated cast car body and machinery table. Bay City will also exhibit a Bay City trailer with dual pneumatic tires designed primarily for handling Bay City shovel models ranging in weight from 10 to 18 tons. No new models have been developed as yet for 1933, but all standard Bay City models have been somewhat improved and perfected in design, cut helical gears have been adopted in place of spur gears on the Model B and improvements have been made along the line of providing for highest speeds of operation, greater precision, less power consumption, improved gearing, minimizing of vibration, still greater ease of parts replacement and still wider use of special alloy materials.

Blaw-Knox Exhibit

Blaw-Knox Co., Pittsburgh, Pa., will occupy Space 145 and will have an exhibit of models and enlarged photographs attractively displayed covering the following products: A new line of improved Blaw-Knox trukmixers and closed agitators; steel forms for general concrete construction; batcher plants and central mixing plants in many sizes and variations; road forms; Ord finishing machinery for concrete and asphalt pavements; Universal forms for curb and gutter, integral curb and pavement construction, clamshell buckets; the Blaw-Knox (Madsen) line of portable asphalt plants; Ateco dirtmoving equipment, consisting of dirtmovers, bulldozers and tamping rollers. The company will be represented at the show by Chester H. Lehman, General Sales Manager and Secretary; Edward M. Ornitz, Sales Manager Construction Equipment Department; Arthur A. Levison, Assistant Sales Manager Construction Equipment Department; William C. Cochrane, Assistant Sales Manager Construction Equipment Department, and district managers and representatives from the various district offices of the company.

Bond to Exhibit Cork Expansion Joint

The Bond Manufacturing Co., Wilmington, Del., will exhibit its newly developed cork expansion joint for use in concrete construction. This cork-tex joint is made of carefully selected cork particles bound together with a phenol formaldehyde type resin. This combination is stated to possess all the permanent resiliency of cork wood, and in addition the chemical permanence of a synthetic resin. The exhibit will be in Booth 370. The company's representatives at Detroit will be George P. Edmonds, R. C. Bostwick, Edward K. Bispham, Jr.

Bragg-Kliesrath Corporation Exhibit

The exhibit of Bragg-Kliesrath Corporation, South Bend., Ind., will consist mainly of B-K vacuum power brake equipment which has been designed for heavy duty use. There will be several axle display stands which will be hooked up to the especially compact B-K units. These are to represent conversion axles, by means of which an operator may modernize his existing brakeless trailers. The exhibit will also contain an operating display stand which will show the difference in pedal pressure required with and without vacuum power. The exhibit will also show the company's latest development, super vacuum power brake equipment. The representatives who will be in attendance are W. E. Babler, D. B. Webster, Leslie Harvey and George Voglesong. The space includes Nos. 301, 302 and 303.

Black & Decker to Show Lodometers

Black & Decker Mfg. Co., Towson, Md., will exhibit its complete line of turtleback drive-on Lodometers. The exhibit will be in charge of E. E. Powell.

Carey Exhibit

The exhibit of the Philip Carey Co., Cincinnati, O., will consist of the following:

Elastite Expansion Joint—Premoulded expansion joint. Elastite Rubber Expansion Joint—Cellular rubber construction for concrete bridges and other locations where non-extruding joint is wanted. Elastite Subgrade Felt—A remarkably strong, tough waterproof sheet, laid continuously under concrete pavement to conserve water in the mix and to eliminate sprinkling. Elastite Asphalt Plank—Greatly improved in toughness, compressive resistance and uniformity; used for a wearing surface for highway bridge floors and other locations exposed to traffic. Elastite Asphalt Flooring—A flooring material for factories, shops, warehouses and other service where not only moving traffic but also heavy stationary loads must be carried. The exhibit will be in Space 148 and will be in charge of C. V. R. Fullenwider, Manager, Elastite Products Division, the Philip Carey Company, Lockland, Cincinnati, O.

J. I. Case Company to Show Industrial Tractor

J. I. Case Company, Racine, Wis., will exhibit, in Booth No. 122, a Case Model "LI" Industrial Tractor equipped with dual pneumatic tires.

They will also have three easels on which will be displayed photographs showing Case industrial tractors at work at various operations in various sections of the country; also have a movie showing road maintenance work in various sections of the country. George Iverson, Sales Manager, Industrial Division; L. L. Hoaglin, assistant to Mr. Iverson in the Industrial Division; F. A. Wirt, Advertising Manager; Tomar Nelson of the Engineering Department; M. R. Comer and G. F. Bartels, salesmen, will be in attendance.

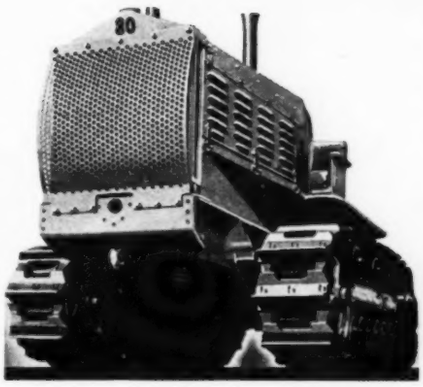
Centaur Tractor Corporation

Centaur Tractor Corporation, Greenwich, Ohio, will show the Centaur Hi-Way Mower in Booth 214.

Mr. C. C. Stedman, Vice-President in Charge of Sales, and Mr. C. B. Hall, Sales Engineer, will be in attendance.

Cleveland Tractor Co. Exhibit

The Cleveland Tractor Co., Cleveland, O., will exhibit the new Cletrac "80" and a Cletrac "35" with a Wooldridge trail-builder. The trailbuilder will be shown in action. Special emphasis will be placed upon the Cletrac patented differentially controlled steering mechanism. A special apparatus embodying the features of the Cletrac steering mechanism will be on exhibit. By the aid of this apparatus it will be simple to explain that Cletracs have the same tractive area while turning, that Cletracs have power on both tracks while steering, and that Cletracs steer the same way down hill as up. Although the Cletrac steering mechanism is not a new development, its features are new to many tractor users.



The Cletrac "80."

The exhibit will be in Space 137-A and 138-B. The representatives in attendance will be as follows: L. D. Ogle, Sales Promotion Department, in charge of the exhibit; King White, President; H. D. Hubbs, Assistant to the President; W. E. Miles, Sales Manager, Industrial Division; G. D. Groce, Service Manager; J. W. Montigney, Traffic Manager, and D. A. Milligan, Equipment Sales Engineer.

Curtis Pneumatic to Show Compressor

Curtis Pneumatic Machinery Co., St. Louis, Mo., will exhibit the Curtis Timken roller bearing carbon free Model "C" portable compressor line. The particular outfit on display will be a 240-ft. portable

Curtis 240-ft. Portable Compressor.

with 6½x5¼-in. four-cylinder "V" type compressor, mounted on four steel wheels. The exhibit will be in Spaces 222 and 238, the representatives in attendance being J. D. Lodwick, Sales Manager; I. B. Lewis, Sales Engineer; R. P. Stone, Sales Engineer.

The Concrete Surfacing Machinery Co.

The Concrete Surfacing Machinery Co., Cincinnati, O., will occupy Booth 105 at the Road Show, with an interesting exhibit of "Berg" equipment. Their display will include the latest models of "Berg" concrete surfacers, highway surfacer, cleaning tool, etc., and the various machines will be shown with electric, air and gas engine motor units. In addition, the complete line of attachments, heads and accessories will be displayed, showing the adaptability of the "Berg" motor units to a large field of applications in the construction and other industries. One of the principal features of this exhibit will be the "Berg" water feed head—Model "W," a recent and novel development which will be on display for the first time. It will be shown as a separate attachment and also as a complete water feed concrete surfacer for wet rubbing all kinds of concrete construction. Mr. M. Wetstein, President, Mr. F. E. Aurand, Jr., and Mr. M. Wolfson will be in attendance.

Dodge Brothers Exhibit

The Dodge Brothers Corporation, Detroit, Mich., will exhibit: One Model G-30 E chassis and cab with 1½-yd. contractors' dump body with hydraulic hoist; one Model F-60 E chassis and cab with 3-yd. contractors' dump body and hydraulic hoist; one Model G-43 2-ton standard chassis; one Model G-30 4-ton heavy duty chassis. The exhibit will be in Space 201. Included in the representatives who will be in attendance will be J. D. Burke, Director of Truck Sales; Allison Miller, Assistant Director of Truck Sales; D. C. McCallum, Detroit Regional Manager of the Fargo Motor Corporation and G. A. Orphal, Special Equipment Sales.

Dow Chemical Co. Exhibit

The Dow Chemical Co., Midland, Mich., have an unusually large and interesting display regarding the uses of Dowflake calcium chloride for road maintenance and construction work. Particular attention will be given to a study of gravel roads and the correct use of calcium chloride for maintenance work, as well as construction and maintenance of sand-clay roads. Also the use of calcium chloride for treatment of sleet covered roads and streets to insure a safe driving condition will be featured. Don Williams, Assistant Sales Manager, will be in charge.

E. D. Etnyre & Co.

E. D. Etnyre & Co., Oregon, Ill., will occupy Booth 309. Literature with illustrations and detailed specifications of the Etnyre bituminous distributor will be distributed.

Euclid to Show New Dump Wagon

The Euclid Road Machinery Co., Cleveland, O., will announce its new Tu-Way hydraulic dump wagon at the Road Show. This wagon is designed to economically handle rock as well as dirt. It is stated that with a fair crown the wagon carries 10 yds. It has a short turning radius, it being stated that with a 50 h. p. tractor it can turn in a roadway width of 22 ft. It has a one-piece body—no doors or down-folding gates. The body plates are 5-16 in. thick and the floor is double plated with 2-in. plank between. The wagon has been many months in the making. Every angle and detail has been carefully studied and the resulting product fully tested under most severe conditions. Euclid's proved features are embodied, including the rugged channel frame construction, the tubular draw-bar with spring-type chassis and Euclid 15-ton "Track-Wheels."

FWD to Have Truck and Race Car Exhibit

The plans of the Four Wheel Drive Auto Co., Clintonville, Wis., call for the display of two 1933 truck models and the Miller FWD Special racing car. The display will be located in Space 113 and a number of prominent FWD officials will be on hand to welcome the show visitors. Those of the FWD organization who will be present are: Walter A. Olen, President and General Manager; R. H. Schmidt, General Sales Manager; H. B. Dodge, Chief Engineer; W. M. Hanson, Advertising Manager; R. W. Pachaly, Chicago Branch Manager, and H. G. Engel, District Representative. In addition, many of the FWD dealers have signified their intention of attending the show.

The new trucks which will be on display are the models H6 of 2-2½-tons capacity, and the CU6 in the 3½-4-ton class. Both have a number of improvements over former series, such as more convenient cabs, more rugged chassis and wider treads. The new H6 model is powered by an L-head motor with a bore and stroke of 3¾x4¾ ins., developing 72 brake horsepower.

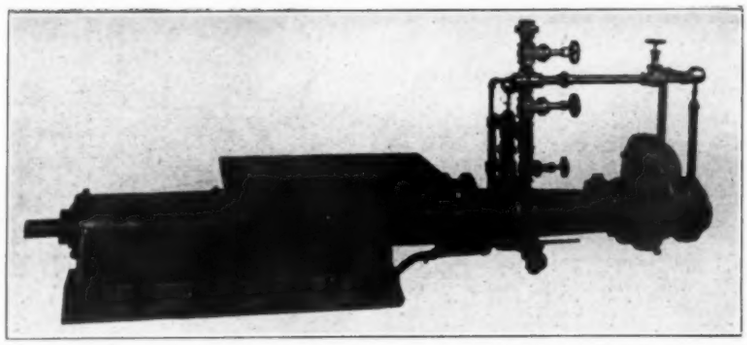
New 1933 Model CU6 FWD Truck.

The CU6 model for 1933 also has many refinements, among which are the new cab, lower mounting of the drive units, and a 72-in. tread. The cab is modern in styling, having an internal sun visor and unit instrument panel, which carries the oil gauge, ignition switch, speedometer, heat indicator and ammeter. The motor in this model is a 6-cylinder L-head unit, developing 91 brake horsepower.

The race car is a Miller FWD Special four-wheel-drive job owned by the FWD Company and produced for them by Harry Miller, famous builder of racing cars.

Fuller Co. Exhibit

The exhibit of the Fuller Co., Catasauqua, Pa., will include a portable Fuller-Kinyon pump, of the type employed for unloading bulk cement and asphalt filler from standard box cars, ordinary barges, and for recovering cement from warehouse storage. Although this machine has been exhibited before, the present model is an improvehment over the company's earlier types of portable pumps, and incorporates a number of features which the experience with these machines during the past several years indicates will make it more attractive to contractors, especially with reference to ease of operation. The company will also exhibit its Type "F" Fuller-Kinyon stationary pump, which it is believed will attract a great deal of attention by reference to its use as a conveyor of bulk cement from hopper-bottom railway cars. It has likewise been applied for conveying from box cars, and is of especial interest in this connection, as it may be driven by a directly coupled gasoline engine. The company also will exhibit a Fuller Rotary single-stage air compressor of the type commonly used with the Fuller-Kinyon pumps on highway and other public works construction. There likewise will be a great many pictures of current construction work to illustrate the layout possibilities of mixing plants under peculiar local conditions of topography, etc.



6-in. Type F. Pump Arranged for Conveying Through a 5-in. Black Steel Pipe Line.

Galion All-Steel Body Co. to Show Models of Hoists and Dump Bodies

In the exhibit of the Galion Allsteel Body Co., Galion, O., will be shown the company's latest models of hydraulic hoists and dump bodies for one and one-half-ton trucks. These are the Galion Models GH-46 and GH-56. Model GH-46 is the heavy duty single lift point job with oversize 6-in. cylinder. Model GH-56 is the heavy duty two lift arm hydraulic hoist with oversize 6-in. cylinder. On both of these hoists a very important and very interesting improvement has been made. A new overflow valve of extremely simple design has been incorporated on the upper end of the cylinder to prevent distortion or breakage of parts where the cylinder is filled too full of oil. The standard bodies will all have increased head ends and endgates. There will be a full 6-in. side board provision so that a standard sand and gravel body can be easily and quickly converted into a coal and refuse hauling body.

Just outside of the main entrance to the Municipal Airport Building will be shown the Galion extra heavy duty hydraulic hoist Model 64-57 mounted on a Dodge Brothers F-40 heavy duty chassis. This particular hoist is designed expressly for trucks rated from 2½ to 6 tons.

GH-46 Hydraulic Hoist.

The exhibit will be in Booths 203 and 210 and will be in charge of G. L. Stiefel, B. J. Heiser, E. Krieger and J. C. Rush.

General Electric Exhibits Motors and Welding Sets

Gear motors and portable welding sets will feature the General Electric Company's exhibit. There will also be a small research laboratory demonstration in conjunction with the company's display. K. H. Runkle and L. W. Shugg will represent General Electric.

General Wheelbarrow Co. to Show Guard Rail

The General Wheelbarrow Co., Cleveland, O., will exhibit its regular items of manufacture, but in addition the outstanding feature this year is its Empire highway guard rail. This is not a new product with the company, but one which it has been pushing in recent months with very excellent success. The exhibit will be in Booth 313. J. M. Rorimer, Vice President, and Roger M. Kyes, Second Vice President, will be in attendance at the show.

Godwin to Show New Safety Island

W. S. Godwin Co., Baltimore, Md., in addition to its steel paving guards for the protection of the edges of paving along streets, roads, railway tracks and concrete curbs, will show its new safety island. This island includes a turret of concrete sufficiently strong to stop any motor ve-

Godwin Safety Island.

hicle with "head on" impact—and a separate concrete platform which is raised 7 in. above the street to guide motor vehicles into their proper driveways. The entire approach end of the turret is covered with a polished, stainless steel; the floodlight, mounted in the bottom of the signal lamp, illuminates the sloping portion of the turret and directs the light toward the approaching motor car. In addition, the upper or vertical portion of the turret returns the headlight rays to the driver. This turret design is particularly effective because it utilizes both vertical and horizontal light rays. The entire assembly for the turret and front part of the island is so designed that it may be set in place and filled with concrete. Both the steel riser or facing which is welded to the curb guard and the reflecting steel front of the turret act as forms for the concrete. The exhibit will be in Booth 103 and W. S. Godwin, President, will be in attendance.

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Goroco Mechanical Spreader Co. Exhibit

The Goroco Mechanical Spreader Co. will again show the Goroco mechanical chip spreader. The exhibit will be in Space 339, where a working model, which gives a graphic illustration of the work accomplished, and moving pictures will be shown. In addition, a full sized unit will be on exhibition, where the simplicity of operation and sturdy construction can be inspected. The wide hopper type, first shown at the 1931 show, has met with popular response. This type hopper permits use of the spread with full tailgate opening, no alteration or attachment to propelling vehicle being required. Steps are provided for operator with control handle regulating the quantity spread, within easy reach. The Goroco is used for the purpose of spreading loose aggregates on

Goroco Mechanical Spreader.

freshly oiled surfaces and during the winter serves the dual purpose of spreading sand, cinders, etc., over icy pavements. The company will be represented at the road show by A. I. Dean and H. N. Bechtel.

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Hazard Wire Rope

The Hazard Wire Rope Co., Wilkes-Barre, Pa., will exhibit highway cable guard, lay-set preformed wire rope and stranded wire rope, and will have a motion picture showing the manufacture of preformed wire rope. The exhibit will be in Booth 246 and L. J. Gignac and W. H. Slingluff will be in attendance.

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Hercules Motors Corporation

The Hercules Motors Corporation, Canton, O., will exhibit its engines. The following will be in attendance: D. W. Latta, Clyde R. Schuler, W. W. Cromley, C. P. Weekes, A. B. Wehling and John Keplinger. They will have headquarters at the Book-Cadillac Hotel.

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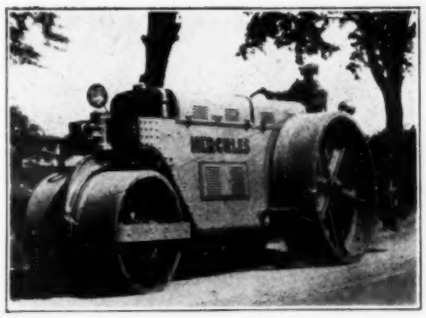
Hercules Company Exhibit

The Hercules Co., Marion, O., will have space No. 234 and expects to emphasize particularly the application of Hercules rollers on low cost road construction and maintenance. There will be a new movie film of Hercules rollers rolling black top road. G. V. R. Mulligan, Manager, Road Roller Sales, will represent the company



Hercules Model 100 Roller.

at the show, and a representative number of Hercules distributors have stated that they will also be in attendance.

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Hercules Products to Show Dump Bodies and Spreaders

Hercules Products, Inc., Evansville, Ind., will exhibit their dump bodies and road spreaders. Booth 217 will house the exhibit. The main feature of the display will be their improved model 202 heavy duty tubeless hydraulic hoist straight side dump body, said to have been sold to quite a few state highway department and municipalities in recent months. An example of one fleet is shown in the illustration. It shows a part of the large fleet purchased by the Indiana Highway Commission of their model 202 dump body which is built with many improved features, such as a heavy duty tubeless hoist with 6-in. cylinder and heavy duty piston rod; single valve control at end of cylinder head; safety check valve in cylinder head instantly sealing oil entering cylinder, preventing body from dropping; permanent stops to prevent body from tipping back past center; heavy steel cross roller shaft to float on piston stem, with case-hardened rollers mounted on each end to eliminate cramping; roller guides to keep the piston stem in perfect alignment; wide spread double lifting arms to raise 5-ton load with body in any position; tie rod anchored around pump at extreme front end of cylinder head to prevent any end movement in cylinder and also help to seal pump head to cylinder; inclined cylinder rigidly mounted and inclined roller tracks to permit most direct drive from truck transmission; hoist pivoted well to rear to permit 50 deg. dumping angle, low loading height and high

Part of Fleet 2, Hercules Model 202 Dump Bodies.

tail gate clearance, and patented adjustable tie rod construction to keep body rigidly in place.

The Hercules universal road spreader for use in road construction and maintenance, dust prevention with calcium chloride and ice treatment will also be on display at the Hercules booth.

Hvass to Show New Retread Mixer-Leveler

The Chas. Hvass & Co., Inc., New York, N. Y., will exhibit a new retread mixer-leveler which they have developed. This equipment can be drawn from either end by means of a tractor or truck, thus eliminating the necessity of turning around. After the stone has been spread on the road surface and the bitumen applied, the Hvass mixer and leveler is drawn through the loose stone. The diamond shaped arrangement of curved blades diverts the path of the stone and turns the stones and bitumen over repeatedly, thus thoroughly coating the stone with bitumen. The mixer-leveler is arranged so that the mixing section can be regulated as to height in order to permit the runners to be placed on the finished half of the road or the shoulder while the mixing blades cut into the bottom of the stone and bitumen at the base where the latter naturally flows. The leveling blade at either end can also be adjusted for height to obtain the required thickness and contour of coated stone. The mixer-leveler mixing frame is 24 ft. long, and the runners 27 ft. long, thus overcoming small depressions or hills in the base. The weight is such that it will hold itself down on the road when drawn through the stone. In order to facilitate the transportation of the mixer-leveler it is constructed in sections which can be readily taken apart. One size mixer-leveler is adjustable to 7, 8 or 9 ft. wide in order to make up 14, 16 or 18-ft. roads in two strips, while another size is adjustable to 10, 11 or 12 ft. wide in order to make up 20-ft. or wider roads in two strips.

The exhibit will be in Booth 141, and will be in charge of Chas. T. Hvass, President, and B. E. Priddy, Secretary.

International Harvester to Exhibit Trucks and Tractors

The exhibit of the International Harvester Co., Chicago, Ill., will be in Space Nos. 116 to 121 and will consist of the Model A-7 heavy-duty International motor truck with dump body, the new T-40 TracTracTor, the McCormick-Deering 1-30 industrial tractor, and a special "cutaway" display of the final drive of the T-20 TracTracTor which was placed on the market about a year ago. This will be the first formal presentation of the T-40 TracTracTor at such a show. This tractor, as well as the T-20, is especially worthy of notice because of accessibility and new type of oil seal construction. The T-40 is powered by a six-cylinder engine and has a five-speed transmission. The T-40 develops a maximum drawbar horsepower of 40 and a maximum engine horsepower of 52, as compared to the maximum drawbar horsepower of 23 and a maximum engine horsepower of 31 for the T-20.

New T-40 TracTracTor.

The overall length of the new T-40 is 141 in.; overall width, 61¾ in.; height over air cleaner top, 65½ in.; drawbar height (high), 17 11-16 in.; drawbar height (low), 11 in.; tread width, 47¾ in.; track shoe width, 16 in., and length of ground contact, 70½ in. The fuel tank capacity is 45 gal. and the approximate weight, 10,600 lbs. The tractor operates at five forward speeds, respectively, 1¾, 2¼, 2¾, 3¼, and 4 miles an hour, and at 2¼ miles reverse.

Iowa Manufacturing Co. Exhibit

The exhibit of the Iowa Manufacturing Co., Cedar Rapids, Ia., will be built around the entire Cedar Rapids line, with special attention given the Cedar Rapids traveling plant mix, straight line one-piece outfit and batch type pre mix plants. The Cedar Rapids bituminous road mixer is equipped with four forward mixing speeds, which permits the operator to control his mixing speed to conform to the windrow conditions. Many interesting reels of moving pictures showing these plants in operation in various sections of the country will be shown by those in charge of their booth. The Cedar Rapids straight line one-piece outfit may be equipped with either vibrator or rotary screens. These plants are particularly designed for jobs using drag line feed and which require several moves before completion of contract. The plant is the last word in portability—for all conveyors, feeders, hoppers, power unit, etc., are mounted on one truck with rubber tired wheels. The only setting up necessary is the leveling up of the truck frame by the use of four screw jacks mounted on the truck frame. The Cedar Rapids Straight Line One-Piece Outfits are available in the following sizes: 9x20, 9x24, 9x36 and Tandem 936-336. The exhibit will be in Booth 112. Those in attendance at the road show will include Howard Hall, President; Kenneth Lindsay, Vice President and Sales Manager; J. D. Aldrich, District Sales Manager, and A. C. Gossard, Assistant Sales Manager.

Hyatt Roller Bearing Co. Exhibit

The Hyatt Roller Bearing Co., Harrison, N. J., will exhibit bearings as used in all kinds and makes of road building and construction equipment. Representatives will be in attendance from home office at plant in Newark, N. J., as well as the divisional offices in Chicago and Pittsburgh. The following, who will be present, will have their Detroit headquarters at the Statler Hotel: H. K. Porter, General Sales Manager; O. W. Young, Chief Engineer; H. M. Carroll, Advertising Manager; C. L. Newby, Divisional Manager, Chicago; J. M. Kelly, Divisional Manager, Pittsburgh; L. F. Stuebe, Sales Engineer; T. R. Russell, Sales Engineer; L. L. Hill, Sales Engineer; Frank Webster, Sales Engineer.

International Nickel Co.

The International Nickel Co., New York, N. Y., does not manufacture machinery of any kind, but it has an important indirect interest in the road building and construction industries because of the important quantities of nickel alloys used in road building machinery and similar equipment. Since this is the first year the company has exhibited at the road show, it is going in on a very moderate scale, taking only a

1933 Model Cedar Rapids Traveling Plant Mixer.

small space and will not display any actual products, but will illustrate, by means of an attractoscope, typical examples of machinery into the construction of which nickel enters. Literature dealing with materials will be available and members of the development staff will be on hand to discuss improved materials of construction with visitors to the show.

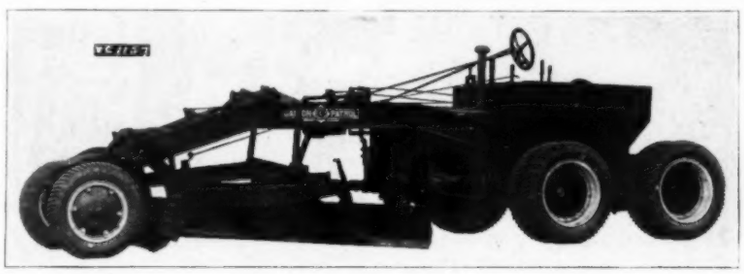
The booth is 312 and the following representatives will probably be in attendance: Charles McKnight, Assistant Sales Manager; H. S. Lewis, Nickel Sales Department; A. G. Zima, Development and Research Department; R. E. Case, Development and Research Department; E. J. Hergenroether, Development and Research Department.

Jaeger and Lakewood Exhibit

The combined Jaeger and Lakewood exhibit at the 1933 Road Show will be photographs and in particular, complete moving pictures of road jobs constructed through the use of side discharge Truck Mixers and Mechanical Spreaders. It is expected this new adaptation of this equipment and the results achieved this year, will make these pictures of specific interest.

Jeffrey to Show Galion Road Equipment

The Jeffrey Manufacturing Co. will exhibit a Galion 10-ton chief road roller



Galion E-Z Lift Motor Grader.

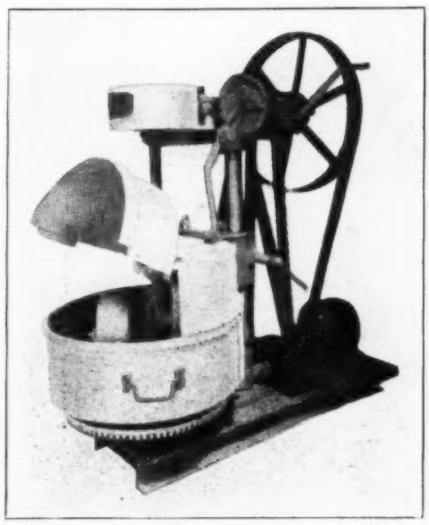
with scarifier; a No. 10 hydraulic operated pull type grader; an E-Z lift motor grader, hydraulic operated; an 8-ft. stone spreader with long runners, and a No. 14 hydraulic operated pull type grader.

Kinney Mfg. Co. Exhibit

The Kinney Manufacturing Co., Boston, Mass., are not showing any equipment at the show, but will have still pictures of its distributors and possibly some of its steam jacketed pumps posted for inspection, and intends to show a reel of moving pictures. This reel gives some unusually good views of the distributors in action, especially at work on penetration construction on coarse type aggregate used by the Massachusetts State Highway Department. One of these machines, owned by the Standard Oil Co., is shown applying the material at the rate of 2½ gal. per square yard on a road 20 ft. wide at one application. The same machine is shown applying seal-coat, ½ gal. to the square yard for the same width. Another machine, owned by the Diamond Match Company, is shown on both construction and surface treatment work applying "Colas" near Poland Springs, Me. Some close-up details are also shown of the machines loading themselves from tank cars, doing shoulder work, and hand hose patching work. The second half of the reel is devoted to detailed construction features of the Kinney Distributor itself. Those in charge of the exhibit will be: H. G. Saunders, manager of the Kansas City office, Kansas City, Mo.; A. J. Munday, manager of the Chicago office, Chicago, Ill.; C. D. Campbell, Jr., manager of the Philadelphia office, Philadelphia, Pa.; C. C. Hill, Boston salesman; W. E. Worcester, vice-president in charge of sales, Boston, Mass.

Lancaster Iron Works to Exhibit Mixer

The Lancaster Iron Works, Lancaster, Pa., will exhibit a batch mixer for mixing asphalts, tar, cement, etc. The machine shown will be the Junior Type "Lancirick" counter current rapid batch mixer with closed pan. The principle of mixing with one of these machines is as follows: The pan of the "Lancirick" mixer rotates slowly and carries the material to an area covered by a mixing star rotating rapidly in an opposite direction. A slow moving current of material meets a fast moving counter-current of material employing the scientific principle of a maximum of irregular ever-changing movements of the batch constituents. The mixing star equipped with blades accentuates activity, causing the individual grains to travel through the entire batch. This constant changing position of the materials, without interruption, without dropping, without being thrown or carried in the air creates a "living" batch. The exhibit will be in Booth 362 and will be in charge of G. A. Pockels.



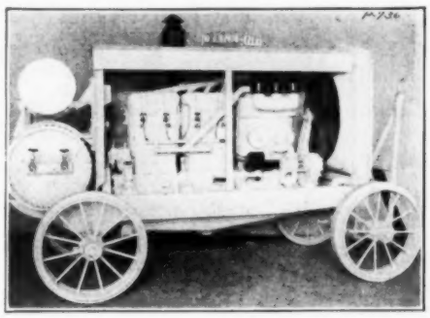
Junior Type Closed Pan Mixer

Leschen Exhibit

The exhibit of A. Leschen & Sons Rope Co., St. Louis, Mo. will consist chiefly of samples of the various constructions in which are furnished "Hercules" (Red-Strand) wire rope for use on road building equipment. Various constructions will be on display, and experineced wire rope men will be able to give valuable information to all wire rope users.

Le Roi Co. to Exhibit New Compressor

The Le Roi Co., Milwaukee, Wis. will exhibit its 235 ft. displacement portable air compressor mounted on rubber tires



Le Roi 235 Ft. Portable Air Compressor

of the solid type. C. W. Pendock, president; P. W. Eells, assistant to the president; T. S. Tuttle, assistant sales manager, and W. R. Karll will be in attendance at the show.

Lincoln to Show Powdered Asphalt

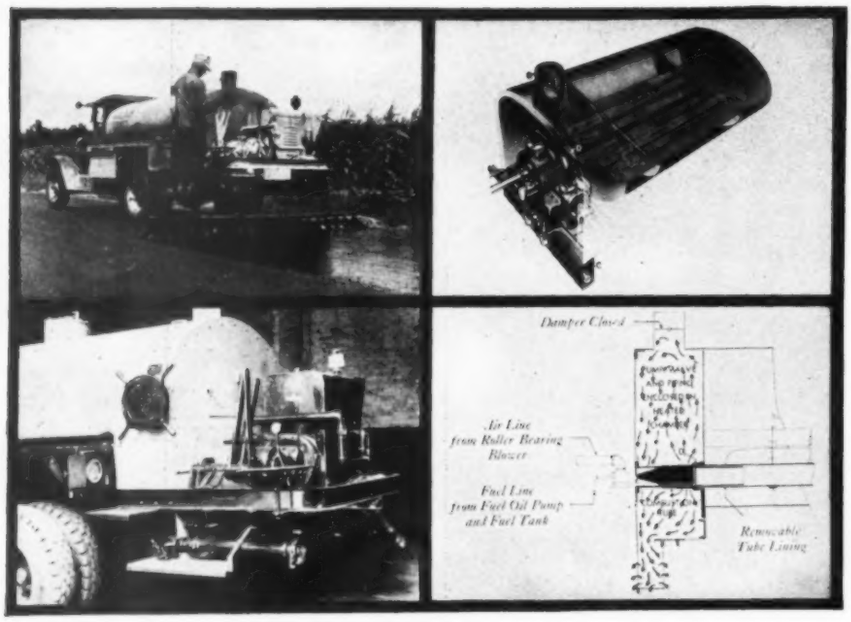
The exhibit of the Lincoln Oil Refining Co., Robinson, Ill. will consist entirely in the displaying of petroleum asphalt products that are used by the road industry and in this display, cutback asphalts, Lincolnite (powdered asphalt) and road oils will be included.

Lufkin Exhibit

The products of the Lufkin Rule Co., Saginaw, Mich. are all relatively small-steel and woven tapes for all kinds of engineering construction work, and rules of almost every type. In order to best display this matter the company will use plate glass show cases. The space number is 149. R. M. Benjamin will be the representative in charge of the exhibit, and he will be assisted by two others from the organization.

Littleford Distributor Taken Apart for Exhibit

Eleven large photographs will be used by Littleford Bros., Cincinnati, O. to show the outstanding features of their Pressure distributor. These photographs are on display in Booth 129. The chief features of the Littleford Distributor are: (1) Single valve control of material—fill, spray, circulate, and drain. (2) Complete positive con-



Group of Photographs Used to Show Details of Construction of Pressure Distributor

trol of all operations from the operator's platform. (3) Low pressure burner that lights instantly requiring no preheating. (4) Heat chamber that encloses pump, valve, and all pipe lines assuring quick starting in cold weather. (5) Heat deflector to preheat operating mechanism. (6) Littleford Continuous Type Heat Flue that is claimed to practically eliminate heat loss and give maximum heating efficiency.

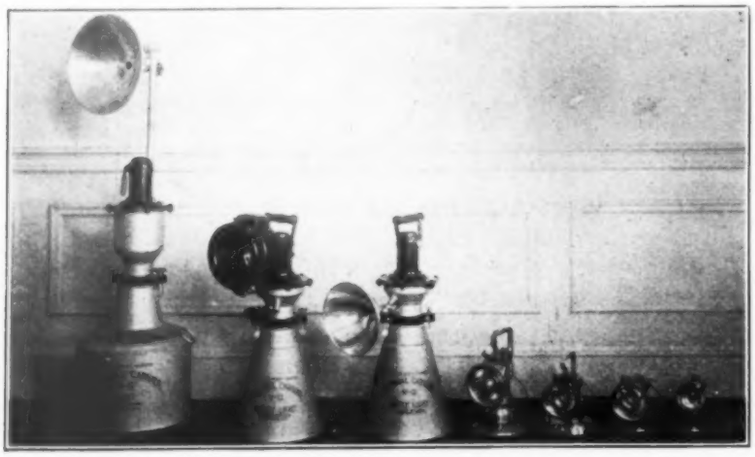
L. W. Glaser, sales manager of the Road Equipment Division of the Littleford Bros., will be in charge of the booth. With him will be Engineer Herbert Haupt, designer of the distributor.

National Carbide to Show Lighting Equipment

The National Carbide Sales Corporation. New York, will show its complete line of carbide lighting equipment, as follows: 1. National Carbide V-G Light, No. X-100. 2. National Carbide Inclosed Model V-G Handy-Light, No. Y-200. 3. National Carbide V-G Handy-light, No. Y-199. 4. National Carbide Lantern, No. WL 1-CI. 5. National Carbide Junior Car Inspector's Lantern, No. WL-2000. 6. National Carbide Journal Inspector's Lamp, No. WL-3000. 7. National Carbide Locomotive Inspector's Lamp, No. WL-1000. It will also display its principal product, National Carbide "In the Red Drum," which is distributed from its network of warehouses from coast to coast. The booth number will be 226, and it will be in charge of R. C. Holcomb, service manager; E. C. Ackerman, Western sales manager, Chicago, Ill. and local sales force in Detroit, Mich. who will be in attendance.

MacWhyte Co. Exhibit

The exhibit of the MacWhyte Co., Kenosha, Wis. will consist mainly of a display of various types of wire rope used by the men attending the show, that is, wire rope for dredges, steamshovels, dragline excavators, sand and gravel pits, derricks, etc. In this display the difference between the use of an ordinary lubricant and a special lubricant will be shown. The booth number will be 239.



Line of Carbide Lighting Equipment of National Carbide Sales Corporation.

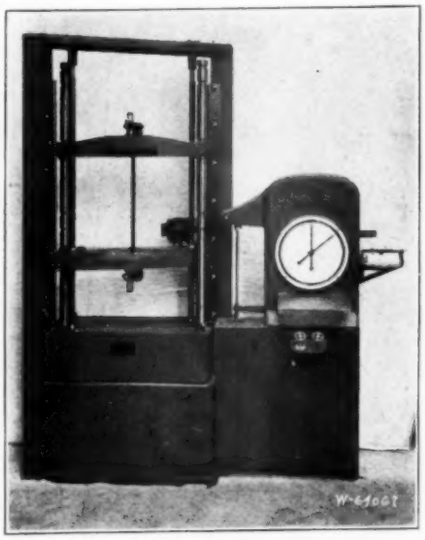
National Paving Brick Ass'n Exhibit

The National Paving Brick Association will have Booth 104 and the main feature of their exhibit will be a miniature auger machine for making brick. G. F. Schlesinger, Chief Engineer and Managing Director, will represent the National Paving Brick Association, not only at the road show exhibit but also at the annual meeting which is held Tuesday and Wednesday at the Book-Cadillac Hotel. Q A. Campbell will be in attendance at the booth.

Tinius Olsen to Exhibit New Testing Equipment

The Tinius Olsen Testing Machine Co., Philadelphia, Pa., will demonstrate some of its latest equipment for testing cement, concrete, etc., besides the testing of materials used in the construction of road equipment.

There will be demonstrated for the first time in any road show the latest type Olsen Hydraulic Universal Testing Machine of 60,000 lbs. capacity with all-lever, self-indicating, with pendulum dial weighing system, as illustrated. The Olsen-Smith High Magnification Autographic will be used in conjunction with this machine for making stress-strain diagrams. A 2,000-lb. capacity Olsen Universal Test-



60,000-lb. Capacity Hydraulic Universal Testing Machine.

ing Machine will also be shown for the first time.

Other equipment to be demonstrated will be the Olsen-Andrew Road Surface Rater, all-metal type, with Olsen Master Straight Edge; Olsen Concrete Beam Tester in conjunction with the Olsen Collapsible Moulds for preparing specimens; the latest Olsen Automatic Shot Type Cement Tester with dual weighing system and initial load regulator in accordance with the lastest A. S. T. M. specifications for grips; an Olsen Ductility Tester of the latest No. 20 hydraulic Motor Driven Type with Autographic; Production Type Motor Driven Brinell Hardness Tester; Olsen-Mohr Portable Brinell Tester will be dem-

onstrated for the first time; Firth Hardometer equipment for testing thin specimens as well as for testing nitrided materials.

In addition to this equipment there will be shown the Olsen-Nardiello Capper for capping Concrete Test Cylinders; being exhibited for the first time at any show. The latest Olsen-Lundgren Electric Spark Semi-Automatic Horizontal Cradle Type Static Dynamic Balancing Machine, Style "S" for balancing crankshafts, flywheels and various rotating parts; also various instruments and strain gauges will be demonstrated.

The exhibit will be under the supervision of B. L. Lewis, T. L. Richards, C. R. Tait and B. E. Ohlson.

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Page Steel and Wire Company to Show Traffic Tape

Page Steel and Wire Company of Bridgeport, Conn., will exhibit in Booth No. 245.

Page Traffic Tape, which is a recent development in the highway guarding field, will be featured, and the exhibit will include motion pictures showing various tests which have been conducted on Traffic Tape.

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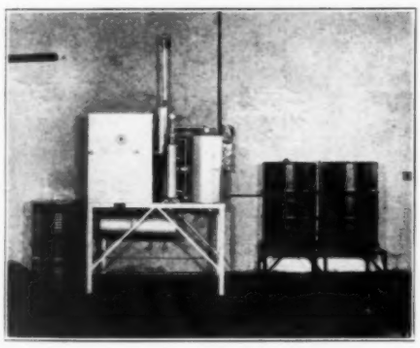
Skinner Motors, Inc., to Show Oil Reclaiming System

Skinner Motors, Inc., Detroit, Mich., will exhibit, in Booth No. 371, the three models of Skinner Oil Reclaiming Systems which are used extensively by highway road commissions, contractors, etc. The descriptive matter attached illustrates



Skinner Oil Reclaiming System.

and describes these machines in detail. The particular model machine most used by these highway departments and contractors is known as the Senior Aviation Model, illustrated. Walter S. Vance, Frank W. Brazel, A. D. Redner, Robert G. Gregory, P. C. Walrath, Paul Williams and James H. Skinner will attend.

▼

Mack Exhibit

The Mack International Motor Truck Corporation, Long Island City, N. Y., will display its model BX, dual-reduction drive dump truck, a heavy-duty unit with powerful and flexible 105 h. p. 6-cylinder engine. A set-back front axle, insuring more effective load distribution and greater tire mileage; heat treated steel frame; heavy-duty Mack rear axle; huge tubular cross members; Mack rubber-shock insulation; 4-wheel foot brakes, actuated by vacuum booster and augmented by independent hand brake, are some of the outstanding mechanical features of this recently announced addition to the Mack line. Modern distinctive appearance is achieved through the use of deep frontal radiator, door type ventilators in the hood, coupe-type cab and high crowned fenders. Mack will also show the 75 h. p. model BG engine; the power plant used in the light-capacity Model BG truck. A series of panels, on which will be mounted the various parts of the BG truck, will afford visitors an opportunity to study Mack components at close range. Rounding out the exhibit will be an interesting display of photographs showing Macks in action on numerous road-building and excavating projects. Representing Mack at Space No. 202 will be M. C. Horine, Sales Promotion Manager; W. T. McCurdy and John Walker.

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Rex-Watson Corp. to Exhibit Watson Dumper

The Rex-Watson Corporation of Canastota, N. Y., will exhibit a 3-yd. Watson dumper in Booth No. 123. S. E. Ackerman, General Sales Manager, and Frederick Heath, Jr., Sales Engineer, will be in attendance and will have headquarters at the Hotel Statler.

3-Yard Watson Dumper.

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Portland Cement Ass'n Exhibit

The exhibit of the Portland Cement Association will consist of illustrations depicting the use of concrete for all types of roads, streets, airports and sewage disposal plants. A particular feature of the exhibit will be the views showing construction details of cement-bound macadam which is receiving widespread attention as a new material in the secondary road field. Emphasis will be placed on this type of construction and there will be on exhibit cores taken from existing pavements of this type. They will also have their revolving cabinet containing colored transparencies of a number of road views in all parts of the United States. A large colored picture will show the use of single track concrete for farm-to-market roads. The exhibit will be in Space 150. E. M. Fleming, Manager, Highways and Municipal Bureaus, will be in attendance and W. F. Tempest and M. D. Catton will be in charge of the exhibit.

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Sauerman Bros., Inc., Exhibit

Sauerman Bros., Inc., 438 S. Clinton St., Chicago, Ill., will exhibit at Booth 233 a 2½ cu. yd. "Crescent" hydraulic

Crescent Hydraulic Scraper.

scraper for operation at the drawbar of a tractor, and will present other Sauerman lines with complete working models. The 'Crescent' hydraulic scraper, which will be on public exhibition for the very first time at the 1933 Road Show, is a new Sauerman product offered to dirt movers within the past few months. It is a self-digging tool with all the features of the "Crescent" scrapers familiar for many years in cable-haul operation.

Working models will picture the operation of the Sauerman slackline cableway excavator; the Sauerman power drag scraper; the Sauerman tautline conveying cableway for the construction of bridges, dams, septic tanks and the like; and the Sauerman drag scraper installed to extend the usefulness of crawler crane or dragline.

Sauerman representatives at the booth will be L. E. Wierks, G. H. Tompkins, J. L. Nellis, J. N. Schufreider and D. D. Guilfoil.

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Scintilla Magneto Co. to Exhibit Bendix Magneto

The Bendix Magneto, a new product of the Scintilla Magneto Co., Inc., Sidney, N. Y., will be exhibited for the first time at Detroit, Jan. 16-20th, and at the Wich-

Bendix Magneto.

ita show, Feb. 21-24th. At each show a special demonstration will be run proving that this magneto is absolutely unaffected by dust, no matter how fine. These magnetos are constructed on the rotating magnet principle—coil, breaker and condenser being stationary. The use of slip rings or collector rings is consequently eliminated The magneto is completely enclosed and fully protected against dust, dirt, oil and water. Adequate air circulation is provided, however, through the magneto. The contact breaker is a new, pivotless design, no breaker lever pivots being used. A large felt wick oiler lubricates the breaker cam. The distributor shaft as well as the drive shaft is mounted on ball bearings, packed in grease. These features enable the magneto to operate for long periods without attention.

Toledo Scale Co.

Toledo Scale Company, Toledo, O., will show the following: Toledo Moisture Determination and Compensation Auto-Gage; Remote Indication Auto-Gage; Graphic Recording Attachment; Photo-Electric Cell Cut-off; Automatic Liquid Control Equipment with Automatic Tare Mechanism.

Continuous motion pictures will show the installations of the Toledo Method of Proportioning Concrete Aggregates by Weight.

The exhibit will be in booth No. 241. Colonel Sidney F. Mashbir, Director, Concrete Aggregate Division, and R. B. Longmate, Zone Engineer, Concrete Aggregate Division, will be in charge.

Solvay Sales Corp. Exhibit

The display of Solvay Sales Corp., in Booth No. 208 will consist of display signs calling attention to the various uses of Solvay calcium chloride and featuring particularly the use of calcium chloride mixed with sand or cinders as an economical measure of safety on icy pavements. The following will be in attendance:

From the New York office: G. H. Kimber, H. C. Todd, R. A. Scott, G. P. Spencer. From the Syracuse office: F. L. Damon, F. G. Calkin. From the Boston office: C. M. Adams, Jr. From the Philadelphia office: Wm. L. Ridpath, K. M. Dillabough. From the Chicago office: V. R. Ewing: From the Cincinnati office: C. A. Kleinhans. From the Cleveland office: G. E. Connell. From the Pittsburgh office: R. M. Hoyt. From the Detroit office: F. H. Harris, A. Phillips, Jr., G. H. Baldwin. From the Grand Rapids office: G. C. Schroeder.

Warren Brothers to Show Construction of Penolithic

The exhibit of Warren Brothers Co., Boston, Mass., will show step by step the progressive stages in the construction of Penolithic pavement, the new type, non-skid, penetration macadam pavement perfected by Warren Brothers Co. and successfully laid by many state highway departments, counties and also in city and town aid construction, to a total of more than one million square yards to date.

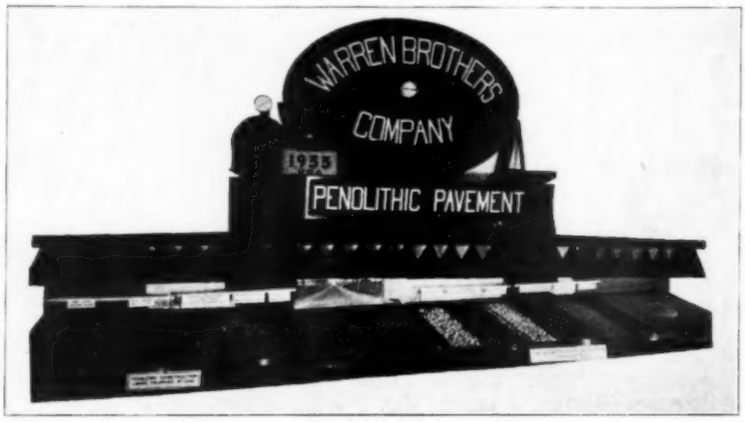
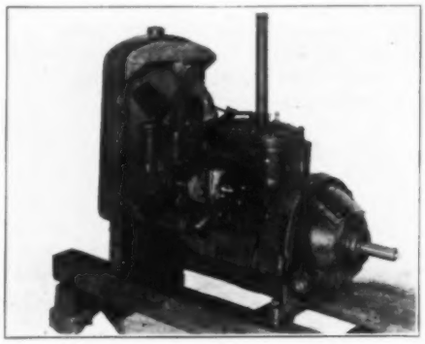


Exhibit Showing Progressive Stages in Construction of Penolithic Pavement.

The space number is 373 and the exhibit representatives are to be W. Lennox Kirkland and Roy F. Wiliams.

Stover Manufacturing & Engine Co.

The exhibit of Stover Mfg. and Engine Co., Freeport, Ill., will be in charge of B E. Avey and Lee Madden will also attend a portion of the time. Included in the exhibit will be the latest addition to their power unit lines, the 4-cylinder job which is illustrated.



Stover 4-Cylinder Power Unit.

Ransome Concrete Machinery Co.

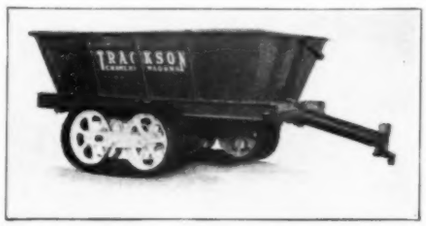
Although Ransome Concrete Machinery Company of Dunellen, N. J., will not exhibit at the road show, they will have a booth in which to meet friends.

Universal Crusher Co. Exhibit

The Universal Crusher Co., Cedar Rapids, Ia., expects to exhibit the following equipment: Model crusher in operation and complete photographic material covering the company's full line of equipment at the airport, Booth 242; Model Crusher with complete photographic material at the Book-Cadillac Hotel Booth 43. Those who will attend the exhibit are as follows: W. L. Harrison, Manager; L. W. Dunlap, Sales Manager; R. D. Conway, Engineer; E. A. Velde and L. S. Hackney, Salesmen; F. L. Shramek, Shop Superintendent.

Trackson Co. to Show New Wagon

Trackson Company, Milwaukee, Wis., will display one of the new 1933 model Trackson 10-13-yd. Crawler Wagons in booth No. 110. L. E. Dauer and R. D. Houghton will be in charge of the exhibit.



Trackson 10-13 Crawler Wagon.

Hotel headquarters will be at the Detroit-Leland.

Timken Exhibit

The Timken Roller Bearing Co., Canton, O., will have Space 247, and the exhibit will consist of Timken Bearings, as used in road building equipment. The following will attend the show: L. M. Klinedinst, Vice President; W. B. Moore, Sales Manager; S. M. Weckstein, Industrial Engineer; H. V. Fleming, District Manager; J. W. Weir, District Manager; R. P. Proffitt, District Manager; B. E. Keifer, District Manager.

EDITORIALS

The Coming Battle Between the Highway and the Railway Industries

In "Printers' Ink," Dec. 8, there is an article by Ralph J. Staehi, Secy., Allied Truck Owners, Inc., describing a recent battle of ballots between railways and motor-truck owners in Oregon. The railways were seeking to load the trucks with more taxes and to restrict their competition. They conducted a publicity campaign that cost about $200,000, but nevertheless were defeated by the truck owners. The latter organized a speakers' bureau that held more than 1,100 public meetings. At the same time newspaper advertisements were used to counteract the railway propaganda. One of their ads reads:

"The Public Be Damned"
Oregon!

"You can't afford to let the railroads get away with this!

The West Railroad Bill has nothing to do with "Highway Protection." It can't reduce license fees.

But—

It raises freight rates in Oregon.
It puts thousands in the bread lines.
It turns over to the railroads Oregon's $150,000,000 investment in highways.
It is the most dangerous, deceptive and costly abuse of the initiative ever attempted in Oregon.

Mr. Staehli states that "posters played an important part in the campaign. Every truck carried a large three-sheet on which was featured the appeal against putting more men out of work, truckmen claiming that the bill involved the jobs of 27,000 people. Radio was used in the last week of the campaign."

The railways caught the truck owners napping in Kentucky and Texas, and secured the passage of bills that were economically vicious. We predict that the Oregon precedent will greatly assist not only in fighting similar bills but in securing repeal of the Kentucky and Texas bills.

"Railway Age," Dec. 1, devotes its entire issue of 96 pages of articles and 252 pages of advertisements to propaganda favorable to railways. Much of the propaganda is an attack on their highway competitors, some of which is amazing in its disclosure either of profound ignorance or of a determination to mislead the public. We believe that to ignorance and not viciousness must be attributed this campaign against motor transportation.

In the February issue of ROADS AND STREETS many of the misleading statements that appear in the Dec. 1 issue of "Railway Age" will be criticized. We speak now not merely of statements in their editorial but in their advertising pages.

It is an unfortunate thing that the railways have started what is developing into the greatest cat and dog fight that has ever occurred between two great industries. Neither of the contestants will profit from it, unless, perchance, it results in freeing the railways from public regulation that has become intolerable. With the advent of the motor-truck and the bus, railways have ceased to be monopolies. Public regulation was introduced to protect the public against transportation monopoly. With that monopoly gone, rate regulation should go.

Doubtless each form of transportation has its own economic field. Let competition determine what that field is.

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A Technocrat Berates "The Price System"

ABOUT 12 years ago Howard Scott became director of a loosely organized group of technical men known as the Technical Alliance, "for discussion of social implications of the machine age." Until about two years ago this group contented itself with discussion, but then Walter Rautenstrauch, professor of industrial engineering at Columbia University, gave Howard Scott an office at Columbia, and thus the prestige of Columbia was loaned to Mr. Scott and the group which shortly afterward began to call themselves Technocrats. The Architect Emergency Committee provided money with which some 30 unemployed architects, draftsmen and engineers were put to work making "an energy survey of North America."

Mr. Scott, the spokesmen of this group, has recently published articles in the "New Outlook" and in "Harper's Magazine" giving a brief summary of this economic survey, plus a long attack on capitalism which he calls "the price system." The magazine "Time" states that Mr. Scott has refused to disclose what, if any, technical school he attended, but says that he was a member of a "cement pouring gang at Muscle Shoals" and "continued to drift around construction camps." It also adds that he was once associated with the I. W. W., which seems not unlikely when one reads his bitter tirades against bankers, manufacturers, business men and political economists, all of whom he seems to regard as nit-wits.

Several newspaper articles by political economists have appeared in answer to Mr. Scott's criticisms of "the price system," and "Saturday Evening Post" plans publishing one by Frank Arthur Vanderlip, banker. Up to the present these critics of Mr. Scott have seemed to regard him as a typical engineer, and therefore a person necessarily ignorant of political and business economics. If he were a typical engineer, their criticism of the engineering profession would be abundantly justified; for seldom has such economic illiteracy been given an opportunity to display itself in high grade general magazines. A few examples of Mr. Scott's economic illiteracy may be of interest.

(1) He speaks of corporation stocks as being certificates of indebtedness, whereas they are certificates of ownership. And he makes the same mistake as to "equities."

(2) He says: "In a price system wealth is produced only by the creation of debt. A man is wealthy only when he is a creditor." So if nobody owes you money and you own an unmortgaged farm or house you possess no wealth!

(3) "Under a price system wealth becomes the ownership of debt." Then in the next sentence but one: "Wealth is the conversion of available energy into use forms, be it potatoes, shoes or electric light." So in one breath wealth is ownership of debt and in the next breath it is a conversion of energy!

(4) "Price is not a measure at all; it is a unit of value." Since the dollar is a unit of value, Mr. Scott virtually says "Price is a dollar"! But immediately after declaring that price is not a measure he asserts that it

is a measure, for: "The only possible way in which a banker can measure a pair of shoes is by calculating their price."

(5) Mr. Scott pictures public utility and railway corporations as never writing off the value of equipment that has been scrapped, but constantly borrowing more money to pay for new equipment that supplants the old. He is blissfully ignorant that the Interstate Commerce Commission and 48 state commissions forbid the very practice that he thinks is prevalent; also that the valuation engineers and accountants of those commissions would expose any departure from the rules laid down by the commissions; and, finally, that the appraisers and accounts employed by the bankers who underwrite bond issues must all be either fools or crooks if new bonds are issued to pay for depreciation.

(6) "The dollar which is used to value a commodity is a purely arbitrary unit and has no metrical equivalent in the physical operation of our continent." So is every other unit of measure purely arbitrary, but what of it? What is "the physical operation of our continent?" One must guess at Mr. Scott's meaning for those five words convey none.

(7) "Its (Technocracy's) methods comprise, among other things, a synthetic integration of the physical sciences that pertain to the determination of all functional sequences of social phenomena." This sentence is a "synthetic integration" of nonsense, as you will see if you substitute commonly used synonyms for the high sounding words. When a "method" becomes a summation of sciences, please communicate with the lexicographers, for they are eager searchers for new meanings of old words.

(8) "Under a price system, debt is the controller, and the bankers are those to whom society has given charge of debt." This will be news to several millions of creditors who are not bankers; and it will also be news to Henry Ford and the shade of millionaire Thomas Lipton who on earth was neither debtor nor creditor.

We make these criticisms of Mr. Scott's language because a loose thinker often discloses his incompetence by his incorrect or meaningless use of words. Of course the main criticism should be that he fails to prove his contention that economic production by the aid of power, other than muscular power, is the cause of unemployment. His "power survey" is intended to show that the capitalist system is doomed, because men are thrown out of work by machines, thus leaving them without ability to buy the products of machines. This argument dates back to the beginning of the "machine age" about 150 years ago. It has been raised anew during every financial depression, but in America machines have continued to multiply and men have continued to use them, without any diminution in the percentage of employed workers during normal times.

All the forebodings of continuing disaster that Mr. Scott makes in 1932 were made half a century ago by Karl Marx, the socialist, and by Henry George, the single taxer. Mr. Scott tells us that unless we scrap the price system at once, we shall see twice as many unemployed two years hence as we see now; yet the reasons back of his prophecy were present in the depression of 1893 with as great force as now. He is apparently unaware that due to invention and discovery the real wage of the average American worker in 1929 was five times what it was a century earlier, because per capita productivity was five fold as great; also that there has been no appreciable change in the rate of increase in per capita productivity during the past decade. But by selecting a few instances of greater than average increase in productivity, and ignoring the many instances that are below the average rate of such increase, Mr. Scott is able to paint a picture of future distress that is as appalling as it is distorted and untrue.

Well informed technicians know that increase in per capita productivity has been distressingly slow instead of appallingly rapid. They are under no delusions of grandeur such as the "technocrats" suffer from. They have seen no sudden metamorphosis of technology. Although longing for wings, technology still crawls with the turtle, at the same pace that it has crawled for three generations.

H. P. Gillette

Highway Signing

"NOW which way do we go? Look for the sign." "No sign here; it's took dark to see any road signs of the type used in this state; they're too high, what few they have." This indicates the state of mind of a traveler on unknown main roads in three of the New England states which the writer traveled recently.

Highway signing is one of the important accessories to highway building and operation. In the states to which reference was made the signs in the main are too inconspicuous, and not of the character to provide the highway user with the most effective direction. Ordinary painted signs are effective if large enough and correctly placed, especially so that night driving lights will strike them. Furthermore, preparatory signs should be placed far enough in advance of a cross-road, Y or T-road to inform the vehicle operator which direction to go at the next intersection. What few reflector type signs were encountered proved very effective to guide us on the dark and rainy nights encountered on this trip. This type of sign placed a few hundred feet ahead of an intersection, which means placing them both ways from the intersection, to tell the motorist what roads are directly ahead gives him a feeling of security in his direction of travel. The feeling of not knowing whether or not one is on the wrong road, and unable to check up on this lost feeling, is disconcerting, aggravating, and useless. At a few places, red reflector-type danger signs could have been placed effectively. One good way of providing unemployment relief would be to tackle the job of adequate, satisfactory signing on all roads, whether they are recently improved or not.

Along with these shortcomings in signing, the writer noticed a very commendable idea in signing on one road. This happened to be a new route and missed a few towns that were on the old road. However, the road passed through two or three towns. The good idea is that of placing reflector-type signs at points where speed is changed. In some places 45 miles an hour was allowed, in other places the speed had to be reduced, especially going through the towns. This left no doubt in the mind of the motorist as to what was the legal or safe speed limit on this particular road. In spite of the New England northeaster that was blowing we were able to drive this road with a sense of security that we would not be arrested for exceeding a local speed limit. State police were on the job too.

Let us look to the operation side of highway work and check up on the effectiveness of present signing methods.

V. J. Brown

The Road Builders' News

A Monthly Newspaper for Highway Progress

JANUARY, 1933

Convention Eclipses Previous Meets

IS PART OF HIGHWAY AND BUILDING CONGRESS

The stage is set for the 1933 convention of the American Road Builders' Association to be the greatest in its history. Endless preparations have been made to present during its sessions, on January 16, 17, 18, the very latest developments in highway construction, maintenance and transportation problems. On January 19 the association will join thirty-five other national organizations in presenting subjects relating to the conservation and continuance of the highway program of the nation. Subjects which are so vital at this time, when such a terriffic onslaught is being planned on highway funds.

Simultaneously with the convention the Annual Road Show will be held. This year, however, it has been broadened to a Highway and Building Exposition, to include equipment and materials used in general building construction. This is in connection with the Highway and Building Congress.

The convention sessions and the exhibit will be held at the Detroit Municipal Airport, where there are ample facilities for the exhibits and meetings.

An unusually enthusiastic interest is being shown in the convention this year. It will be attended by state, county and city highway officials and engineers as well as contractors, manufacturers, distributors and motor freight operators.

Attractive railroad and air travel rates have been authorized for the convention and highway and building congress, as well as local transportation and hotel rates in Detroit.

It is expected that the registered attendance will be the largest yet recorded.

MANUFACTURERS MEET TO DISCUSS 1933 PROGRAM

Within the past three weeks manufacturers of highway equipment and materials have met in New York, Cleveland, Chicago and Milwaukee. These meetings were called by the American Road Builders' Association to acquaint the manufacturers with the true conditions relating to future highway construction and the necessity for action in upholding gasoline tax and motor license revenues for highways. It was pointed out that during the past year these funds have been diverted to many purposes foreign to that for which the tax was created—that in so doing the progress of the nation has been impeded—the present business depression has been prolonged and that nothing of a permanent gain has been accomplished by it.

The meetings were well attended, by presidents and other officials of the companies represented. A very keen interest in the future highway program of the country was expressed and whole-hearted support was pledged for the conservation of gasoline tax and motor license revenues for highways only.

ROAD BUILDERS ORGANIZE TO SUPPORT HIGHWAY LEGISLATION

Advisory Councils are being formed in each state by the American Road Builders' Association to support favorable highway legislation. The councils will consist of members of state, county and city organizations, contractors and manufacturers. They will keep the association in constant touch with highway legislative matters and serve as a distribution agency for highway facts and figures.

Too much stress has been laid on the use of gasoline tax and motor license revenues for purposes other than highways—such as diverting these funds to welfare. Little do the advocates of such measures realize that in proposing such diversion they are materially increasing their welfare problems. Statistics prove that 85c out of each dollar in highway construction goes to labor, either directly or indirectly. By reducing highway construction thousands of men now gainfully employed in actual construction on the highways, in equipment factories or material plants will be thrown out of work and on to welfare. By retaining gasoline tax and motor license revenues for highways at least these thousands of men now employed will not be added to the already overloaded welfare problem. An article covering this subject as well as others which are being advocated by highway construction adversaries will be furnished members of the council in an educational program for the conservation of gasoline tax and motor license revenues for highways.

Many solutions to the tax problems of the individual states will be introduced at the coming state legislatures and it is expected that to a large degree the importance of continuing the highway program will be retained through the membership of the state councils.

Council membership has been completed in several of the states and is nearing completion in the remainder. It will be ready for action when the first state legislature convenes in January.

ELECTION OF A. R. B. A. OFFICERS

Nomination for officers and directors of the American Road Builders' Association and its city officials and county highway officials' divisions for the year 1932-1933 have been accepted, ballots have been mailed to the membership and election announcement will be made during the 1933 convention of the association.

GENERAL ASSOCIATION

H. C. Whitehurst

Herbert C. Whitehurst, Washington, D. C., has been nominated for next president of the American Road Builders' Association. His name heads the ballot which now is being circulated among the membership of the organization, the returns of which will be tabulated and announced during the forthcoming annual convention in Detroit, January 16-20.

(*To page* 49, *column* 3.)

HIGHWAY AND BUILDING CONGRESS PASSES IN REVIEW

The Highway and Building Congress to be held at Detroit in January will bring together the largest number of groups interested in highway and building construction and highway transportation ever assembled at one time.

Most of the twenty-one organizations participating are directly interested in highways, and represent material producers, manufacturers of equipment, sale of equipment, highway extension, and highway transportation. Several of the participants are affiliated with building interests and many of them are active in both. The engineering branches will be represented by several nation-wide associations.

The following information gives an idea of the broad field and diversified highway construction, building, transportation and engineering interests which will be represented at the congress.

American Road Builders' Association

T. H. Cutler

This is an association of highway engineers, contractors, transport operators and equipment manufacturers. Activities include committee studies on highway construction, maintenance, finance and operation. The association carries on its activities through separate divisions which include county highway officials, city officials, and manufacturers. Unorganized divisions include contractors, engineers and officials, Pan-American and European. Technical and scientific information is published by bulletins and annual proceedings.

Headquarters—National Press Bldg., Washington, D. C.

President—T. H. Cutler, State Highway Engineer, Jefferson City, Mo.

Engineer-Director—C. M. Upham, 938 National Press Bldg., Washington, D. C.

Associated Equipment Distributors

A. C. Blaisdell

This organization is active in the study of all factors connected with the sale of road machinery. Trade practices are given major consideration.

Headquarters—Chamber of Commerce Bldg., Cincinnati, Ohio.

Secretary—A. C. Blaisdell, Chamber of Commerce Bldg., Cincinnati, Ohio.

Construction League of the United States

Robert D. Kohn

This league was recently organized to co-ordinate the various elements that compose the construction industry of the United States. Its membership includes national associations serving all branches of the construction industry. The associations in the league are listed as follows:

American Institute of Architects.
American Institute of Steel Construction.
American Road Builders' Association.
American Society of Civil Engineers.
Associated General Contractors of America.
Contracting Plasterers' International Association.
International Cut Stone Contractors & Quarrymen's Association.
International Society of Master Painters and Decorators, Inc.
National Association of Marble Dealers.
National Association of Master Plumbers of the United State
National Committee of Building Congresses.
Producers' Council, Inc.
Roofing and Sheet Metal Industries Conference.

Headquarters—1741 New York Ave., Washington, D. C.

General Chairman—Robert D. Kohn, The American Institute of Architects, 56 W. 45th St., New York, N. Y.

Joint Secretariat—E. C. Kemper, 1741 New York Ave., Washington, D. C.; E. J. Harding, 222 Munsey Bldg., Washington, D. C.; Charles M. Upham, National Press Bldg., Washington, D. C.

International Association of Public Works Officials

The association is primarily interested in street sanitation. Recently standards for street sanitation and other public works activities have been established.

Headquarters—100 N. La Salle St., Chicago, Ill.

President—C. Schneider, City Hall, New Orleans, La.

Secretary—A. M. Anderson, 100 N. La Salle St., Chicago, Ill.

American Society of Municipal Engineers

The activities of this society include the study of all forms of municipal engineering. The society has written standard specifications for sewers, sidewalks and curbs, and various kinds of pavement surfacing.

Headquarters—St. Louis, Mo.

President—John H. Neeson, 1103 City Hall Annex, Philadelphia, Pa.

Secretary—W. S. Sammelman, 4359 Lindell Blvd., St. Louis, Mo.

American Welding Society (Detroit Section)

The society, through its committee, engages in the study of all phases of welding. The society is represented in six sectional committees of the American Standards Association. Committee work is carried on jointly with The American Society for Testing Materials, American Electric Railway Engineering Association, National Research Council, and others interested in welding practice.

Headquarters, Detroit Section—5950 Third Ave., Detroit, Mich.

Secretary-Treasurer—Robert P. Bailey, 5950 Third Ave., Detroit, Mich.

Materials Handling Institute

WITH MATERIALS HANDLING DIVISION OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS COOPERATING

The sixteen divisions of the society are active in the study of aeronautics, applied mechanics, fuels, hydraulics, iron and steel, machine shop practice, management, materials handling, national defense, oil and gas power, petroleum, steam power, printing machinery, railroads, textiles and wood industries.

The Materials Handling Division is cooperating with the Materials Handling Institute in the study of the handling of all kinds of building material.

Headquarters—29 W. 39th St., New York, N. Y.

Meetings and Divisions Assistant—P. T. Wetter, 29 W. 39th St., New York, N. Y.

Secretary, Materials Handling Institute—Mr. Cronin, 29 W. 39th St., New York, N. Y.

National Association of Builders' Exchanges

One of the main objects of this association is the promotion of uniform building laws throughout the country. The association co-operates with the U. S. Bureau of Standards, The American Institute of Architects, and the American Standards Association in its standardization activities.

Headquarters—Bond Bldg., Washington, D. C.

President—William Sharp, 22 N. Fifth St., Reading, Pa.

Executive Secretary—Earl F. Stokes, Bond Bldg., Washington, D. C.

H. T. Kaiser

Associated General Contractors of America

This organization is sponsored by highway and general contractors and is active in the study of all problems connected with the contracting business. Prequalification of bidders and standard bidding and contract awarding codes are sponsored by this association. Standardization of several types of contracting equipment has resulted from co-operation with various manufacturing associations.

Headquarters—Washington, D. C.

President—H. T. Kaiser, 1522 Latham Square Bldg., Oakland, Calif.

Managing Director—E. J. Harding, 222 Munsey Bldg., Washington, D. C.

Roy W. Crum

Highway Research Board

This is an organization included in the division of engineering of the National Research Council. The Highway Research Board is concerned with standards for road materials and construction and with the compilation of a safety code for automobile brakes and brake testing.

Headquarters—2101 Constitution Ave., N. W., Washington, D. C.

Director—Roy W. Crum, 2101 Constitution Ave., N. W., Washington, D. C.

Geo. N. Farny

National Crushed Stone Association

The commission is actively engaged in studies concerning the scientific planning of county highway systems. The studies are being made in the field and reported in bulletin form. A comprehensive study is now being made in Morris County, New Jersey. A Planning Manual for county highway development will be published by the commission in a few weeks.

Headquarters—Craftsman Farm, Morris Plains, N. J.

Chairman—Major George N. Farny, Craftsman Farm, Morris Plains, N. J.

A. L. Worthen

National Paving Brick Association

This association is engaged in drawing up standards for methods of testing and for specifications for various types of highway materials which make use of crushed stone. The association has recently completed a system of cost accounting as applied to the crushed stone industry.

Headquarters—1735 14th St., N. W., Washington, D. C.

President—A. L. Worthen, 67 Church St., New Haven, Conn.

Secretary—T. R. Boyd, 1735 14th St., N. W., Washington, D. C.

O. W. Renkert

National County Roads Planning Commission

This association is engaged in research pertaining to all factors connected with brick pavements. In co-operation with other associations, this association has published standard specifications on vitrified brick pavements and bituminous filler.

Headquarters—National Press Bldg., Washington, D. C.

President—O. W. Renkert, Metropolitan Paving Brick Co., Canton, Ohio.

Chief Engineer and Managing Director—G. F. Schlesinger, National Press Bldg., Washington, D. C.

Sand-Lime Brick Association

This association took an active part in the work which led to the adoption by industry of one standard size of sand-lime brick as given in a simplified practice recommendation promulgated by the United States Bureau of Standards. The organization co-operates with the federal government in working out specifications for the purchase of common sand-lime brick.

Headquarters—Saginaw, Mich.

President—F. Langdon Smith, 539 Penobscot Bldg., Detroit, Mich.

Truck Association Executives of America

H. C. Kelting

The national association has in its membership officials of state motor truck associations and is organized to study the problems of the motor truck industry.

Headquarters — Indianapolis, Ind.

Chairman — H. C. Kelting, Louisville, Ky.

Secretary-Treasurer—Tom Snyder, 415 S. Pennsyvania St., Indianapolis, Ind.

ELECTION OF OFFICERS

(*From page* 47, *column* 3.)

Capt. Whitehurst, who is director of highways and co-ordinator of engineer departments and utility company activities in the District of Columbia, is nationally known in the highway engineering field.

Capt. Whitehurst served as assistant engineer commissioner of the District of Columbia until February 1, 1932, when he was appointed director of highways of the District. His present position brings under his direction the following municipal divisions: Streets, bridges, trees and parking, electric, survey and municipal transportation. He also is co-ordinator of public improvement work.

Capt. Whitehurst has long been active in the affairs of the American Road Builders' Association. He was president of the City Officials' Division of the association from 1928 to 1930. During the same interval he also served as a director of the general association. He was elected a member of the board of directors for a three-year term in 1931. In addition to these activities, he has served as chairman or member of numerous committees of the organization during the past several years.

CITY OFFICIALS DIVISION

Col. R. Keith Compton

In the selection of Col. R. Keith Compton, director of public works of Richmond, Va., to be president of the City Officials Division of the American Road Builders' Association the division is particularly fortunate. For more than forty years Col. Compton has been actively engaged in municipal public works and is today recognized as one of the outstanding public officials of the country. His wide experience in the municipal field dates back to 1890 when he became associated with the engineering department of the city of Baltimore as assistant engineer on sewer construction. He remained with Baltimore City until 1898.

1911-1917—Chairman and construction engineer, Paving Commission, Baltimore, Md., in charge of all construction, admin-

(*To page* 50, *column* 3.)

J. E. Burke

National Ready Mixed Concrete Association

This is a recently organized association engaged in collecting data relative to the factors affecting the production, use and quality of ready-mixed concrete and is co-operating with other associations in the preparation of specifications for ready-mixed concrete.

Headquarters—Munsey Bldg., Washington, D. C.

President—J. E. Burke, Ready Mixed Concrete Co., 27 Barbeau St., Pittsburgh, Pa.

Secretary—V. P. Ahearn, Munsey Bldg., Washington, D. C.

W. G. Armstrong

National Rural Letter Carriers' Association

This organization, representing the rural mail delivery, is interested in the extension of rural highways and for several years have co-operated closely with the American Road Builders' Association in its sponsorship of the farm-to-market road.

Headquarters—1311 G St., N. W., Washington, D. C.

President—W. G. Armstrong, Niles, Mich.

Secretary—Clifton J. Brown, Franklin, Tenn.

H. V. Owen

National Sand and Gravel Association

The major activities of this association relate to the standardization of requirements for materials. It is also engaged in field and laboratory work for the purpose of developing the best practices for using aggregates for a wide variety of purposes. Studies also include cost accounting and safety standards for sand and gravel plants.

Hearquarters—Munsey Bldg., Washington, D. C.

President—H. V. Owen, Eastern Rock Products Corporation, Utica, N. Y.

Secretary—V. P. Ahearn, Munsey Bldg., Washington, D. C.

E. J. Mehren

Portland Cement Association

This association, in co-operation with several others, has written specifications for portland cement, concrete and concrete aggregates, construction of buildings, highways and other structures. The association conducts a research laboratory engaged in studying concrete and concrete materials.

Headquarters—33 W. Grand Ave., Chicago, Ill.

President—E. J. Mehren, 33 W. Grand Ave., Chicago, Ill.

General Manager—W. M. Kinney, 33 W. Grand Ave., Chicago, Ill.

Arthur Swanson

Steel Founders' Society of America

This society develops specifications and standards for materials used in and products of the steel foundry industry. A standard sales contract, order acceptance, and quotation sheet form has been adopted for use between steel foundries and their customers for simplification purposes.

Headquarters—932 Graybar Bldg., New York, N. Y.

President—Arthur Swanson, The Falk Corporation, Milwaukee, Wis.

Managing Director—Granville P. Rogers, 932 Graybar Bldg., New York, N. Y.

Asphalt Institute

This organization is active in the development of specifications covering liquid asphaltic road materials for use in the surface treatment construction and maintenance of various types of bituminous wearing courses.

Headquarters—New York City.

President—W. H. Kershaw, The Texas Co., 135 E. 42nd St., New York, N. Y.

Managing Director—J. E. Pennybacker, 801 Second Ave., New York, N. Y.

Society of Automotive Engineers

This society is engaged in standardization work which covers all phases of automotive and aerial engineering. Approved standard specifications adopted each year are published in its hand-book. Progress is being made in formulating a standard method of rating motor trucks for the purpose of securing uniform technical requirements in the regulation of motor vehicles by the states.

Headquarters—29 W. 39th St., New York, N. Y.

Secretary and General Manager—John A. C. Warner, 29 W. 39th St., New York, N. Y.

Standards Manager—R. S. Burnett, 29 W. 39th St., New York, N. W.

ELECTION OF OFFICERS

(*From page* 49, *column* 3.)

istrative and executive work of the commission for the expenditure of $16,000,000 on paving, as such, handled contracts for all classes of standard paving.

1917-1919—Major, Engr. Corps, U. S. A.; honorable discharge, June, 1919; promoted to Lt. Col., Engr. Reserve Corps.

1919-1924—Chairman and construction engineer, Paving Commission, Baltimore, Md.

1924-date—Director, public works, Richmond, Va.

Col. Compton brings to the division a wealth of experience which combined with his outstanding executive ability and personal charm fits him completely for this most important post.

COUNTY OFFICIALS' DIVISION

Hal G. Sours

Hal G. Sours, County Engineer, Summit County, Akron, Ohio, long active in the affairs of the American Road Builders' Association, will be the next president of its County Officials' Division. He will succeed in that post W. O. Washington, County Engineer, Cameron County, Brownsville, Texas.

Mr. Sours was graduated in engineering from the University of Akron. After several years' experience in highway and general construction work, he became associated with the Ohio State Highway Department. His first post was that of resident engineer for Summit County, of which Akron is the county seat.

In 1924 Mr. Sours was elected county engineer, an office which he has retained ever since. He still continues to represent the state highway department in the county as resident engineer.

Mr. Sours' association with the American Road Builders has been continuous and active. He is at present a director of the County Officials' Division and has been chairman of the Committee on County Highway Maintenance for the past three years. Moreover he has been chairman of the Committee on Recent Practical Developments in Design and Construction of Brick Pavements.

New Equipment and Materials

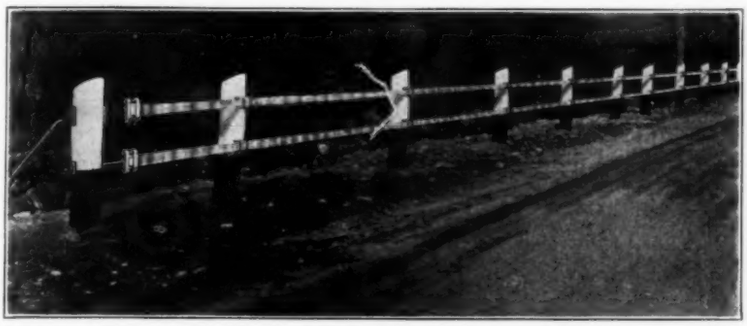
A New Highway Guard Rail

A new type of guard rail has been recently placed on the market by the Page Steel & Wire Co., Monessen, Pa. It is called Page traffic tape. This new item contains the same size wires and the same number of wires as standard ¾-in. cable. Instead of twisting the 21 wires into a cable, similar double galvanized wires are woven into a flat band 2½ in. wide—the wires being held in place by half-round clips woven through them at 6-in. intervals.

Some of the advantages claimed for this new construction are as follows: Elimination of the helical twist increases the tensile strength. Change in shape increases the visibility by three times from ¾ in. to 2½ in. This greater area at point of impact reduces damage to vehicle by eliminating the shearing action of narrow cable. Page traffic tape being rigid in the plane vertical to the ground there is less sagging, while the vehicle is stopped gradually because the tape is flexible in the plane parallel to the ground. Page traffic tape does not constitute a snow removal barrier as do the wider types of guard. It can be stretched on existing posts, either round or square, without change.

Erection of anchorage, line posts and stretching is similar to that used for cable. Attachment to post is made with fittings which offset the tape 4 in. to reduce danger of post breaking through direct contact with the vehicle. Upkeep is comparatively low. Due to the bright galvanized finish it is unnecessary to paint the tape when first erected. When painting does become necessary the flat tape is easily covered.

Shipment is made on wooden reels carrying 2,500 ft. Page traffic tape is stated to be within the price range of standard cable construction.



Installation of Page Traffic Tape Showing End Construction

New Expansion Joint

A new metal air compression type joint has been brought out by the American Concrete Expansion Joint Co., Chicago. The joint consists of a base webb built of 26 gauge steel, crimped in the center at the bottom and flanged on both sides. A rolled strip which runs from end to end between the webb provides stiffening against collapse when pouring concrete against its sides or when tamping. At intervals of 14 in. rolled thread sockets are placed through the walls of the webb.

Phantom View of Ace Joint in Place

These provide a place into which the dowel sockets may be screwed. The upper cap is made of 16 ounce copper, has an inverted U-type construction, and has 2½-in. flanges which extend into the slabs on both sides and become bonded with the concrete through slots punched in the flanges. A wood strip covers and serves as a cap, providing protection during the period of insertion and assuring a straight edge line for each slab when the concrete has hardened. The wood strip is then removed and a bituminous filler poured in. Thickened edge construction, as specified in some states, is provided for by a shoe which slides on the ends of the joint. A cap for the ends is provided by means of a plate fastened in a slot in the metal walls of the webb. A sliding plate is placed on the bottom of the thickened edge shoe and is pushed under the construc-

Strainers for Self-Priming Centrifugal Pumps

All steel, electric welded strainers for self-priming centrifugal pumps are a recent product of the Rife Hydraulic Engine Mfg. Co., 75 West street, New York, N. Y. They were first developed for a contractor who was having trouble from the clogging of his pumps. The strainers have an outer suction area varying from ten times the area of the suction hose in the 2-in. to five times in the 8-in. The openings vary from 3/16 to ¼ in. in width and are usually 1½ in. long, and will prevent objectionable material from entering pump, and with so many openings a part of them at least will remain open to take in water. After the strainers are assembled they are completely hot galvanized.

A tube is welded on the inside of the strainer to bring the suction as near the bottom of strainer as possible, and leave a passageway equal to the hose area. This feature permits complete de-watering of sump. When used in quicksand or extremely soft mud it is recommended that the bottom be covered with canvas or sheet iron to prevent sinking.

The strainers can be made with any size strainer openings wanted, and the 2-in. to 8-in. sizes are kept in stock.

Rife Strainer for Self-Priming Centrifugal Pumps

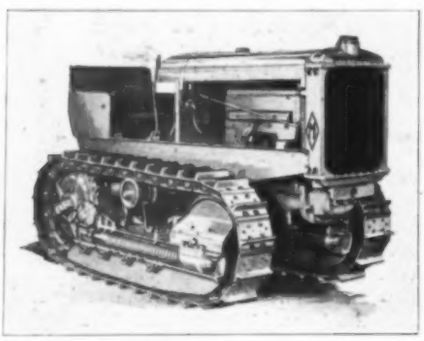
tion curb wall at each end of the joint. The joint has sufficient flexibility to assume a road crown of 1½ in. without any degree of distortion. Vertical position of the joint is assured because when pegs or road pins are vertically driven through the slots they touch both sides of the wall and the bottom flange of the base webb.

A companion unit is the Ace construction joint, built with an inverted U winged top. The vertical section of the joint has two definite corrugations of such dimensions that when the retaining pegs are driven into place they touch both sides of the slot and the outer edges of the corrugations on each side. Holes for dowel bar insertion are provided as specified. Placement of this joint in a straight line is assured by a recessing of the wing tops in such manner as to guarantee a positive accurate fitting of one into the other.

With both joints positive protection against seepage of water through the joint is provided by the winged type construction.

New Track Type Tractor

The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has added another tractor to its line. This is the Model M. It follows the general design of the A-C Model 35 and Model L. This new achievement of Allis-Chalmers is modern in every feature and is equipped with four speeds forward, renewable cylinder sleeves, unit



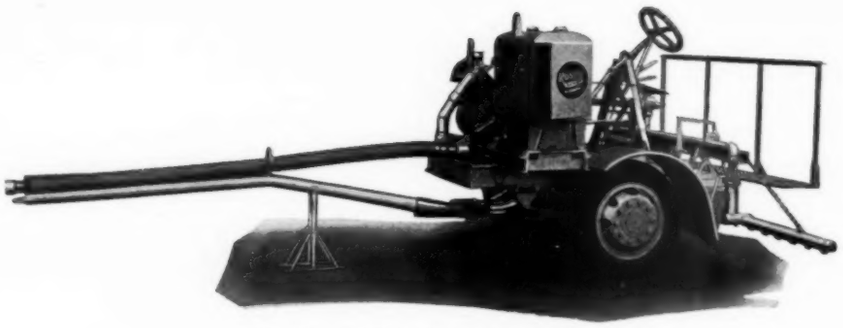
A-C Model M Track-Type Tractor

construction, steering clutch control and many other features. Ample power is furnished by a modern engine that will deliver approximately 28 drawbar horsepower. The Model M weighs 6,200 lbs. and the track shoes are 12 in. in width. The tractor has a variation of speeds of 2.23 to 5.82 miles per hour.

New Bituminous Distributor

A new distributor for bituminous material has been placed on the market by Thomas W. Rosholt Co., Minneapolis, Minn. The entire spraying mechanism consisting of the power plant, the Rosco patented 7-Way valve, pump and folding spray bar, is mounted on a two wheel trailer. The suction line from the 7-Way valve is supported along the pole and attached to the transfer tank at the other end.

The applicator allows the distribution of the bituminous material to be made from the supply tank without transferring it to the distributor unit. The advantage is of course the speed with which the applicator



The Rosco Bituminous Applicator.

can be moved from one tank to another. The Rosco applicator has some novel features among which is the platform leveling device. By turning a hand wheel, the platform can be kept level regardless of the height to which the pole must be lifted when hooking on a truck. This assures the spray bar being maintained at an even height from the ground.

A steering device is also provided which allows the operator to offset the applicator a distance of 8 ft., center to center, and still keep the spray bar transverse to the road. The truck then rides the hard surface while the applicator can travel on the softer shoulders.

Improved Wehr Power Grader

The Wehr Co., Cudahy, Wis., has announced the improved Wehr Model UZ grader. The main frame and cab assembly is electrically welded. The circle and lifting mechanism has been improved to a point nearing perfection. The controls respond with the slightest touch. The lifting screws are supplied with an adjustable brake which can be set when maintenance is done over a long stretch of road where the blade is to be held in one position. The blade side shifting mechanism is hung between the main frames—being installed on the heavy gusset plates which are part of the tubular member which is welded directly to the main frames. With the side shifting mechanism in this position, and all attachments removed from the main motor yoke, radiator trouble is eliminated. The "A" frame is an especially rugged, extra heavy unit, electrically welded to give the greatest strength. The one piece circle is continuous, without any joints, welds, or seams, and the heavy duty ramshorns welded and rjveted to it are supported with re-inforcing truss members with the heavy angles supporting circle. Mounted in the center of the "A" frame is a steel casting containing a roller thrust bearing. The shaft, welded in the circle casting extends through the upper casting and bearing supported by a dust proof cap and adjustable lock nut. Large machined surfaces on these castings are stated to assure accurate adjustment and to positively eliminate blade chatter. An efficient circle turning device is also available for this grader. It has a positive arrangement of an enclosed worm and gear, shaft, pinion, and gear rack. The gear housing nests between the "A" frame angles and the rack is internal with all working parts properly sheltered.

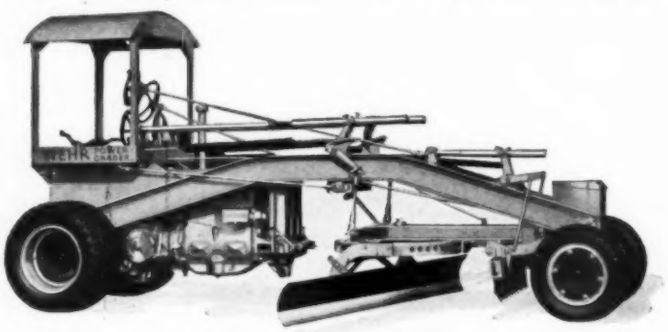
An all around scarifier providing two holes in the teeth and six in the box provides a great variety of working angles. This scarifier is a fast operating screw type unit of very high efficiency.

There are a number of very desirable features such as extra heavy steel castings throughout including the rear end mounting brackets, bell cranks, miscellaneous arms, brackets, and levers, counterbalanced hand wheels, steel checkered floor plate, roomy tool box, extra heavy adjustable mouldboard brackets with several positions and numerous refinements not found in the average grader priced considerably above this job.

The 1933 Austin-Western Line

The 1933 line of the Austin-Western Road Machinery Co. is reported to be the finest ever placed on the market by this long-established, well-known concern. Major power developments of special interest to road builders, and numerous other improvements to effect greater strength, increased flexibility and better control, are the noticeable features of the late model A-W units.

All Austin blade graders, now made in



Wehr Model UZ Grader

12, 10 and 8-ft. sizes, are quite similar in general appearance and all have the exclusive box type frame.

The new hydraulic controlled Austin motor graders and Austin contractors' special elevating graders are likewise a decided advance over the previous Austin models. The adjustments of those parts formerly requiring heavy muscular effort are now actuated by powerful hydraulic controls, requiring negligible effort on the part of the operator. Both elevating and motor graders have been greatly simplified for easy and more positive manipulation, enabling them to do more and better work in much quicker time.

The new Austin shovel, convertible into a crane, back-filler, clamshell and drag line, the bituminous distributor, and the complete line of three-wheeled tandem and pup-sized rollers have all undergone improvements that make them far better pieces of equipment for present-day use. A recent addition to the line is the new Austin truck plow.

Among the outstanding Western products are the new No. 6 elevating grader with shouldering attachment and the large capacity portable washing, crushing and screening plants that have operated so successfully in all parts of the country during the past year. In addition there are the well-known crawler dump wagons, new power wheelers, and other widely used small tools. A large number of these units will be on display at the Detroit show.

Ohio Power Shovel Co.'s Developments

Supplementing the Lima 101 convertible cable crowd excavator in 1 and 1¼ cu. yd. dipper capacities, the Ohio Power Shovel Co., Lima, O., in July, 1932, introduced a complete line of gasoline, electric and Diesel shovels, cranes, draglines and backdiggers in sizes ranging from ¾ to

1½ Cu. Yd. Type 601 Lima Shovel

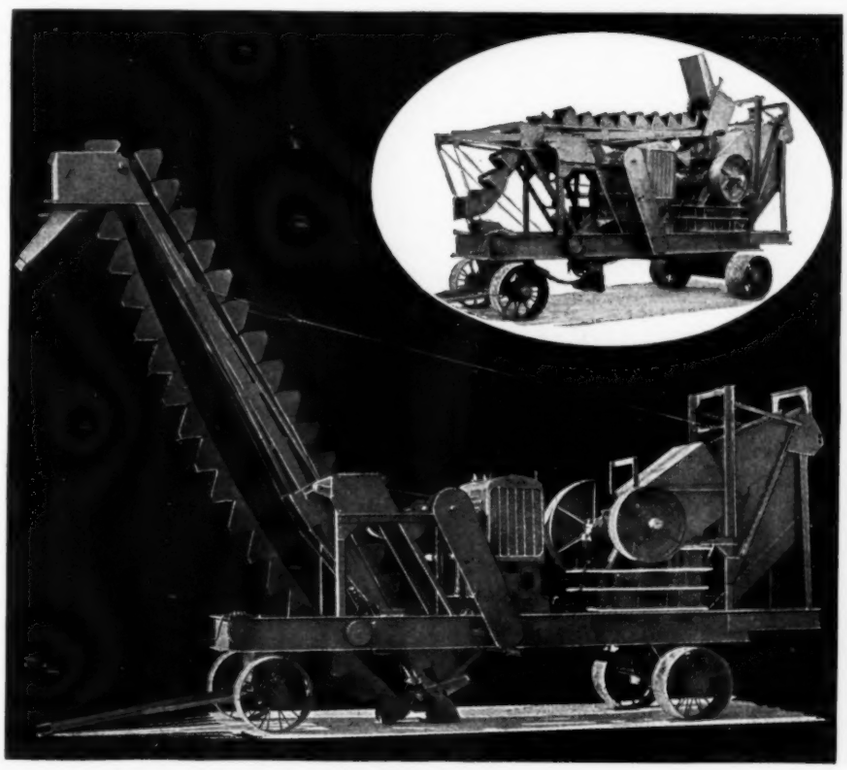
1½ cu. yd. capacities. These types are designated as the type 302, ¾ cu. yd. shovel, or 12 ton crane; type 404, 1 cu. yd. shovel, or 16 ton crane; type 502, 1¼ cu. yd. shovel, or 20 ton crane, and type 601, 1½ cu. yd. shovel, or 25 ton crane.

Many novel and exclusive features are incorporated in their design. All of the machinery, including four cone rollers, drums and shafts, operate on roller bearings. All of the gears in the machinery have helical cut teeth. The combined advantages of these two exclusive Lima features result in the smooth operating and almost noiseless and frictionless long life excavator. The synchro power clutches are of an entirely new design and are exceptionally easy to operate.

All operations are independent, therefore making it possible to hoist, crowd, travel, swing, steer and raise or lower the boom all at the same time. All operating levers are mounted on square shafts. All main shafts on which are mounted sliding members are splined for accuracy and fit. Drums are of extra large diameter, thus affording remarkable cable economy. Extra long crawlers can be applied when operating in soft ground and when greater bearing area is desired.

Pioneer Type "H" Truck with Primary Crusher and Bucket Elevator

As an addition to the 40 series quarry combines, the Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn., has developed the Type "H" truck on which is mounted a 1536 primary breaker with grizzly bars and motor to drive the crusher and the bucket elevator. This combination was made to be used with a standard No. 3 shaker mounted on a 21-yd. bin. The materials are fed to the grizzly bars by means of a standard feeder conveyor. The rock over 2 in. passes over the grizzly bars directly into the crusher. The materials under 2 in. pass through the grizzly bars onto a short conveyor belt running lengthwise of the truck under the crusher. All the materials, both from the grizzly bars and from the crusher, are delivered by this conveyor belt into the boot of the bucket elevator.



New Pioneer Crusher and Elevator Combination

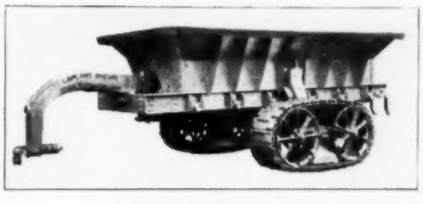
The bucket elevator delivers the materials to the receiving end of a No. 3 shaker mounted over the 21-yd. bin. The rocks that are still too large to pass through the perforations of the No. 3 shaker screens are returned to the crusher by means of a conveyor mounted at the side of the bin. All the power for driving the shaker screen conveyors and the bucket elevator is furnished by the motor mounted on the main truck.

LaPlant-Choate Announces New 12 Yd. Wagon

The LaPlant-Choate Manufacturing Co., Inc., of Cedar Rapids, Iowa, announces the manufacture of a new bottom dump. "Roadlayer" wagon (designed for use with the new larger tractors), that will haul a 12 yd. heaped capacity load.

Departing from the conventional "sloping-side" wagon, this wagon has been built with straight wagon body sides. It is stated the extra wide doors and high clearance permit the wagon to be quickly and easily dumped and hauled off the windrow, with very little increase in draft. The instant the doors drop, the draft immediately lightens so that it is not necessary to shift gears while on the dump.

The wide flange provided at the top of the wagon box is designed to carry a large



LaPlant-Choate Wagon.

top load, and has proven to be particularly advantageous when loading with dragline, shovel or elevating grader, as there is less spill when the load is being rounded up. Among the other important improvements is the lightness of draft which has been accomplished by improved design and perfected machining of all the "Roadlayer" parts.

Improved Blaw-Knox Line of Trukmixers

The Blaw-Knox Co., Pittsburgh, Pa., has announced a new line of improved Trukmixers and Agitators, which are rated 1, 1½, 2, 3, 4 and 5 cu. yd. capacity as Trukmixers, and 1, 2, 3, 4, 6 and 7 to 8 cu. yd. capacity used as closed agitator bodies. Every detail in this new mixer design has been made from a viewpoint of obtaining the lowest possible maintenance cost, as well as extending the useful

Rear View of Blaw-Knox Trukmixer.

life of the mixer far beyond any averages previously established. Strength and sturdiness are also provided without excessive weight. Aluminum alloy castings have been used in this Trukmixer wherever feasible to reduce weight to a minimum. Roller bearings and ball bearings reduce friction, power consumption and wear.

The power unit of the Blaw-Knox Trukmixer is entirely separate from that of the truck and consists of Hercules 4-cylinder gasoline engines of the most modern type in all sizes up to the 5-cu. yd. mixer where a 6-cylinder engine is utilized. This power unit is equipped with air cleaners, which clean the air both for the carburetor and the crank case. The charging and discharge doors are ample in size and fitted with solid oval rubber gaskets. This method of door construction provides a tight fit at all times and avoids warpage of the door, as no excessive strain is necessary to fit it tightly even though obstructed.

The mixing efficiency of the improved Blaw-Knox Trukmixer is derived through a unique arrangement of mixing blades. These blades are not only arranged for quick and effective mixing, but also for quick discharge which is concentrated at the bottom of the discharge opening, obviating overflow and clogging. Blaw-Knox Trukmixers are equipped with a one-man chute, which is ingeniously carried on one side of the Trukmixer and arranged so that one man can easily and quickly hook the chute in place beneath the discharge spout.

Dual controls are provided for operation of Blaw-Knox Trukmixers which includes a complete set of controls for throttle, clutch and gear shifts at the front of the mixer and another complete set at the rear end of the mixer—enabling the operator to run the Trukmixer from either end of the unit with equal ease and efficiency. These controls are interlocked so that there is no chance for any confusion or mistakes.

All transmissions are of Blaw-Knox design and made of the best material available. For the 1-yard mixer and 1½-yard mixer the transmission has a steel case and is of modern, automotive type; for the 3-yard Trukmixer and larger sizes the transmissions which were formerly furnished for these Trukmixers will apply. These transmissions have proved themselves entirely adequate and worthy in service, and are equipped with cast aluminum cases to save weight. All Blaw-Knox transmissions have S.A.E. heat treated steel gears and shafts. Radial bearings and thrust are of the ball bearing type. The bevel gears are adjustable. These transmissions include an automotive type automatic brake.

New Developments in Etnyre Bituminous Distributor

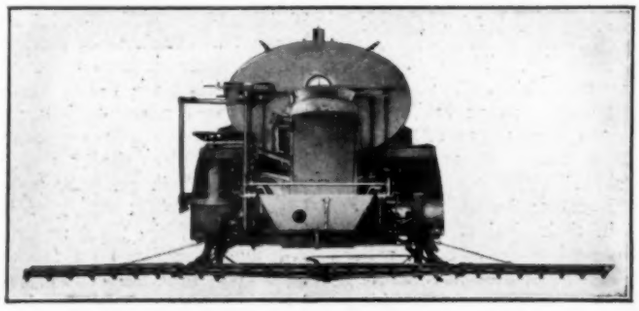
The spraying attachment that E. D. Etnyre & Co. of Oregon, Ill., now offers to meet the requirements of highway departments demanding better construction and neater work by prohibiting the use of road oilers that are not equipped to instantly stop the drip from the nozzles after spraying, is of the circulating type with a valve at each nozzle which provides instantaneous action. This attachment is the result of three years of constant study and experiment in an effort to supply something new and better.

The spray bar is supported on universal brackets and the pipe connections are made up with ball joints so that it can be raised, lowered and swung 9 in. to the right or left of center. The spray bar is made up in sections. The center section is made of a 3 in. seamless steel tube welded at each end to one of the branches of a Y-shaped header. The end sections are made up in 2, 4, 6 and 8 ft. lengths of 2¼-in. seamless steel tubing and these end sections are connected to the header by the use of a hinged connection, which turns on a tapered seat. The connections on the end section permit extending the bar to any desired length. The 14 ft. bar is shown in the accompanying illustration. Although the end sections can be easily and quickly attached and detached, it is not necessary to shorten up a long bar to spray a narrow strip as any nozzles or group of nozzles can be thrown out of service by disengaging any lever or section of levers on the nozzle valves. By raising the end sections, the overall width is within the required limit for travelling back and forth to the job.

Although the spray bar is of the circulating type it is not necessary to circulate the material through the bar during the process of heating for it is connected at each end of the center section to a three-way valve on the primary circulating system. This primary system, which is completely inclosed in a metal housing to prevent radiation, is used not only for circulating material to distribute the heat uniformly throughout the load and to provide agitation to prevent coking, but also for filling the tank. The only time the material is circulated through the spray bar is preparatory to spraying and then only long enough to warm up the valves for easy operation. The two three-way valves on the primary circulating system and the nozzle valves are all linked together and controlled by a single lever provided with a latch that engages either one of two other valves. There are but three operating positions of the levers. In one position, the material is circulated through the primary circulating system. When filling the tank, the lever is in the same position. In the second position, the material is circulating through the center section of the spray bar, and in the third position the nozzles are spraying perfectly.

The valve action is fool-proof for there is no position of the levers which can cause injurious pressure in the lines or danger in any way. Raising, lowering or shifting of the spray bar does not interfere with or affect the valve action. The raising, lowering and shifting operations as well as the valves are controlled by levers all located convenient to the operator's seat with the single exception of the one lever that turns the valve for hand spraying, which is placed in convenient reach of the operator on the ground.

The seat for the operator is placed at the rear end on the left side of the frame in an elevated position where the operator is in position to see the ends of the sprays and shift the spray bar to follow the edge of the road or make a perfect match at the center. There is a convenient step up to the operator's platform which is provided with a railing extending around the back of the operator's seat to protect the operator.



Distributor with Spray Bar in Operating Position.